Development of Natural and Social Science Learning Programme (IPAS) in Elementary School with Understanding by Design (UbD) Framework to Improve Concept Mastery and Problem-Solving Ability

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Article Info	Abstract
	Education as an advanced level without any limitations. The learning process is certainly related to concept mastery. However, the reality experienced by students is that students lack interest in learning, requiring students to memorise material. Of course, concept mastery provides solutions to solve problems in life. It is students make decisions appropriately, often encountering field conditions that show that the ability to solve problems in learning science in elementary schools, namely the teacher does not provide problem encouragement, students feel less concerned about solving problems in their environment. The purpose of the research is to test the effectiveness of a product developed on the application in improving concept mastery and problem solving for the IPAS learning programme in elementary schools with the Understanding by Design (UbD) framework. This research uses development research method and ADDIE model. Based on the research using subject matter expert validation and learning process and language expert validation. The research subjects were teachers and students of class IV SD 17 &1 1 Muhammadiyah 11. In the data analysis technique using descriptive and quantitative techniques, namely interviews and teacher and student response questionnaires. Based on the results of the study, the developed product was declared valid by learning material and learning process experts with an average assessment at stages I and II obtained 97.50%, while language experts at stages I and II obtained an average of 98.00%. Based on the results of the teacher response questionnaire and grade IV students obtained. In the teacher's response to small group and field trials (large) obtained an average of 94.37%. While the student response questionnaire with an average of 93.14%. The results of the effectiveness test of the application of the learning programme development results were obtained and calculated the average pretest of 40 and the average posttest was 71.06. After using the gain normality test, the result is 0.51. It can be concluded that the development of IPAS learning programme for elementary school with Understanding by Design (UbD) framework is feasible to be applied in learning.

INTRODUCTION

Education is a change in attitude and behaviour in learning. Education as an ongoing process that never ends (Sujana, 2019). The learning process is certainly related to the mastery of concepts is closely related to a person's thinking process In the learning process in the 21st century using discovery learning using the development of knowledge, skills, and attitudes (Daga, Wahyudin, & Susilana, 2022). The independent curriculum implements policies formed by the government over time by undergoing changes or improvements regulated by the education policy stipulated in number 371 / M / 2021 concerning the design of driving schools, which explains that the design encourages educational units that make improvements and promote vision in education in Indonesia. The design can be implemented through the independent curriculum which is a refinement of the 2013 curriculum which prioritises learning outcomes containing the Pancasila learner profile (Javanisa, Fauziyah, Melani, & Rouf, 2022). This independent curriculum contains the Pancasila learner profile programme developed by the government (Kemendikbudristek, 2022). This is related to the Pancasila learner profile programme, where the teacher acts as a designer of effective project module strategies, namely backward design or Understanding by Design (UbD) (Rohmadi, 2022). According to McTighe&Willis (2019) says that Understanding by Design is based on a backward design process to plan curriculum learning units that include the desired understanding and performance tasks that require transfer (McTighe & Willis, 2019).

In essence in education that has been associated with backward design starting from designing the syllabus, determining the process and then ending with the assessment results. in this syllabus design can solve problems and is considered an important starting point with backward design being a tradition for curriculum. In using the understanding by design approach understanding becomes an important role as the right curriculum design can help students in understanding (Hosseini, Chalak , & Biria, 2019).

According to Robert et al (2023) said that thinking skills consist of several, namely learning, understanding, remembering, benefits, experience and applying in the field of study (Lombardi & Conley , 2011); (Jr & Ellis, 2023) Menurut Susilaningsih, et al (2019) concept mastery is to instil students' knowledge well (Susilaningsih, Dratisianti, Lastri, Kusumo, & Alighiri, 2019). In mastering the concept of science is the ability that students have in understanding science material, so this is what is important in mastering the concept of science, which does not require students to memorise, but to understand a concept (Safitri , Sujana, & Aeni, 2023); (Wahyuni, Sudin, & Sujana , 2020). The things that cause low mastery of concepts are according to Maesyarah et al. (2020) are 1) many terms of foreign words or Latin that are not understood by students, 2) lack of student interest in reading, understanding concepts and 3) students' limitations in the lack of utilising internet media to keep up with technological developments for science (Fatimatuzzohrah, Jufri , & Mertha, 2020). Factors experiencing a lack of mastery of concepts in learning are factors in the student's situation in the form of factors such as physical conditions, namely the condition of students who are tired and still sick which causes students to be less excited and sleepy, this can affect student learning outcomes, attitudes, knowledge or abilities, namely slow learning which causes students' abilities to be below the potential below the average in children in general. and the student's own learning motivation. This can cause mastery of low concepts so that students have to repeat. and the student's own learning motivation. Meanwhile, external influencing factors can be teachers, the use of learning models, learning tools, playmates, and relatives (Nurmaya, Susilawati, Zuhdi, & Hikmawati, 2021); (Efendi & Putri , *Studi Literature Kesulitan Siswa Pada Pembelajaran IPA di Sekolah Dasar*, 2022). Mastery of concepts in science helps solve problems in everyday life (Amanda, Sumitro, Lestari, & Ibrohim, 2022).

Problem-solving skills can be seen as a fundamental underpinning of science learning (Wardani , 2020). According to Wardani (2020) Problem solving is an intellectual skill that is higher and more complex than other intellectual skills, so that in solving problems, high-level rules must be required by mastering the rules of defined concepts (Wardani , 2020). In problem solving in science learning in elementary school is still lacking and from the results of science learning, namely the teacher does not encourage students to solve problems, to look for reference sources is still limited, students feel bored quickly and lack of care in solving environmental problems around them, and there is no teaching material that trains students in solving problem solving skills. From the reality in the field, this is a factor in the low problem-solving ability (Wahyudiana, Sagita , Iasha, Setiantini, & Setiarini,2021). Based on the fact that Indonesia is very low in problem solving in the results of the (OECD) Organization for Economic and Development in the Science category which says that Indonesia is ranked 62 out of 70 countries, this shows that problem solving skills are still below average (Daryanes , et al., 2023). This IPAS learning expects students to learn about the natural environment and recognise their social environment and be able to develop it in their daily lives. This IPAS learning emphasises direct understanding and develops competencies so that students can study nature and the surrounding environment. This is very important in solving problems because from some of the problems that occur will find alternative solutions or solutions to problems. According to Astuti, IPAS subjects can be developed in critical thinking skills through the PBL learning model (2019) The characteristics of the PBL model can be presented such as the existence of problems, conveying problems in the surrounding environment, grouping, being creative in describing problems, identifying problems and conveying the results of problems (Astuti T. P., 2019). Based on researchers conducting interviews with fourth grade teachers with the problem of students struggling to understand foreign words in IPAS learning. So it is necessary to research

"Development of the IPAS Learning Process in Elementary Schools with the Understanding by Design (UbD) Framework to Improve Concept Mastery and Problem Solving Ability". However, this study aims to analyse the feasibility of the IPAS Learning program in Primary Schools with the Understanding by Design (UbD) Framework to Improve Concept Mastery and Problem Solving Ability.Problem-solving skills can be seen as a fundamental underpinning of science learning (Wardani , 2020). According to Wardani (2020) Problem solving is an intellectual skill that is higher and more complex than other intellectual skills, so that in solving problems, high-level rules must be required by mastering the rules of defined concepts (Wardani , 2020). In problem solving in science learning in elementary school is still lacking and from the results of science learning, namely the teacher does not encourage students to solve problems, to look for reference sources is still limited, students feel bored quickly and lack of care in solving environmental problems around them, and there is no teaching material that trains students in solving problem solving skills. From the reality in the field, this is a factor in the low problem-solving ability (Wahyudiana, Sagita , Iasha, Setiantini, & Setiarini,2021). Based on the fact that Indonesia is very low in problem solving in the results of the (OECD) Organization for Economic and Development in the Science category which says that Indonesia is ranked 62 out of 70 countries, this shows that problem solving skills are still below average (Daryanes , et al., 2023). This IPAS learning expects students to learn about the natural environment and recognise their social environment and be able to develop it in their daily lives. This IPAS learning emphasises direct understanding and develops competencies so that students can study nature and the surrounding environment. This is very important in solving problems because from some of the problems that occur will find alternative solutions or solutions to problems. According to Astuti, IPAS subjects can be developed in critical thinking skills through the PBL learning model (2019) The characteristics of the PBL model can be presented such as the existence of problems,

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METHOD

This research method uses development. According to Maydiantoro (2021) that development research (Research and Development) is research that uses the RnD method or (Research and Development) which develops a product to test and develop in the world of education (Maydiantoro, 2021). The product to be produced is an IPAS learning programme with Understanding by Design (UbD) framework to improve Concept Mastery and Problem Solving Ability. The research uses the ADDIE model, namely analysis, design, development, implementation and evaluation (Arkün & Akkoyunlu, 2008); (Setiawan, Rakhmadi, & Raisal, 2021).

The first stage of this analysis uses performance analysis and needs analysis. Performance analysis uses knowing the mastery of concepts in Chapter 1 Plants, Sources of Life on Earth, which initially IPAS learning is not optimal, learning only requires memorization and lack of emphasis on problems in grade 4. So it is necessary to evaluate the formative assessment and learning outcomes of grade 4 students learning IPAS, while the needs analysis is to analyze the learning program in the preparation of teaching modules.

Secondly The planning of this research uses the Understanding by Design (UbD) design format.

Third Development in the IPAS learning programme is 1) preparing the IPAS learning programme with the Understanding by Design (UbD) framework, 2) Prepare teaching modules and student modules for grade 4 Chapter 1 Plants, Sources of Life on Earth, 3) Validation test of the design of the IPAS learning programme with the Understanding by Design (UbD) framework related to learning objectives, material suitability, and learning steps of the Problem Based Learning (PBL) learning model, this is done by material and learning process expert validation and language expert validation. This requires consultation from a team of experts. To be feasible or not in the IPAS learning programme. After this process, implementation is carried out.

The fourth implementation was carried out in small group trials and large field group tests. The small group trial at SD Muhammadiyah 17 at this stage involved grade 4 students, the purpose of the small group trial researchers was to test the teaching module. While the large field test at SD Muhammadiyah 11, the purpose of the large field test researchers was to develop research and and obtain the results of the assessment of learning programmes with the Understanding by Design (UbD) framework and the response of class IV. After the results have been disseminated and maximised according to the needs of the teacher and adjusting school facilities and infrastructure.

Fifth, evaluation of each stage is carried out, the aim is to get feedback in product evaluation.

The types of data collection in the study were observation, interviews, questionnaires, documentation, and test questions. The subjects in the study were SD Muhammadiyah 17 including teachers and grade 4 students, SD Muhammadiyah 11 including teachers and grade 4 students.

Data analysis techniques used qualitative and quantitative data. Qualitative data obtained from observations and interviews in the form of small notes. Quantitative data is questionnaire

data assessing the feasibility of the IPAS learning programme and assessment of pretest and posttest results using the gain normality test. Gain Normality Test is used as measuring student learning outcomes between before learning and after learning. The formula according to Meltzer used is as follows (Meltzer, 2002):

$$\text{Normality Gain} = \frac{SPost - Spre}{Smaks - Spre}$$

Note :
Spost : Posttest Score
Spre : Prettest Score
Smaks : Maximal Score

Table 1. Gain Normality Test Criteria

Nilai Gain	Criteria
0.70 = n = 1.00	High
0.30 = n = 0.70	Middle
0.00 = n = 0.30	Low

RESULTS AND DISCUSSION

In the results of this study developed an IPAS learning programme product with the Understanding by Design (UbD) framework and developed a student module on the material of Chapter I Plant Sources of Life on Earth. Researchers use the Research and Development (RnD) method and use the stages of Analysis, Design, Development, Implementation, Evaluation which can be developed as follows (Maydiantoro, 2021).

The first analysis required research Performance Analysis and needs analysis. Performance analysis is based on conducting interviews with 4th grade teachers of SD Muhammadiyah 11 in Chapter 1 Plants, Sources of Life on Earth, that learning IPAS teachers still have difficulties, namely choosing words that are easily understood by students, learning is not optimal, learning is rote, students have difficulty understanding and students rely on rote learning methods. In mocking up questions students answer with the excuse of not remembering, and not really understanding foreign words in IPAS learning, so it requires analysis in evaluating providing formative assessments and as learning

outcomes for grade 4 students. The Needs Analysis required by the teacher is to create an IPAS learning programme with the Understanding by Design (UbD) framework.

Second Planning. This stage uses the IPAS learning programme with the Understanding by Design (UbD) framework.

Picture 1. IPAS Learning Programme Cover

Third stage of development with Understanding by Design (UbD) framework for grade 4 elementary school. Requires expert validation of material and learning processes and expert validation. This can be seen in the table Recapitulation of Material and Learning Process Expert Validation Results and Language Expert Validation.

Table 1. Recapitulation of Material and Learning Process Expert Validation and Language Expert Validation Phase I and II

Stages of Expert Validation	Percentage Result
Material and Learning Process Expert Validation Phase I	95%
Expert Validation of Material and	100%

Learning Process Phase II	
Linguist Validation Phase I	96%
Language Expert Validation Phase II	100%

Based on the average validation of material experts and learning process stages I and II obtained an average of 97.50%, and the validation of language experts obtained 98.00%. Here are some suggestions from validators 1) The first revision of the validator's suggestion related to concrete learning media, initially the researcher did not add because it used concrete learning media, then the validator suggested adding pictures or supporting documents for examples of leaf bone types. 2) Second in the Understanding by Design (UbD) framework, researchers only use times new rowman fonts, then can be revised again and get advice from validators to use interesting fonts Not using times new roman, using interesting fonts. This was done to make it easier and more attractive when opening the page on the IPAS learning programme. Then the researcher changed the Cambria font and added a header. 3) The third revision in providing material, the researcher received suggestions from the validator, namely that the picture needs to be given a description. This aims to know more clearly the types of leaf bones. And make a student book or module to reduce misunderstandings in students and teachers.

Fourth, the Implementation stage, at this stage the researchers tested the Understanding by Design (UbD) framework IPAS learning programme, based on the results of the teacher response questionnaire conducted at SD Muhammadiyah 17 and SD Muhammadiyah 11 obtained an average questionnaire of 94.37%. Implementation was carried out 1) Small Group Trial at SD Muhammadiyah 17 with 26 students. Based on the questionnaire description, students prefer IPAS learning using practice and groups for difficulties, namely students still have difficulty in distinguishing various kinds of roots and parts of topic C plant reproduction and

students still do not understand foreign words such as: photosynthesis, chlorophyll. The results of the student response questionnaire obtained an average of 91.27%. 2) The large field trial was conducted at SD Muhammadiyah 11 with 33 students. In the pretest and posttest assessment results, the pretest score was 40 while the posttest was 71.06. And the results of the questionnaire were 95.02%.

Fifth evaluation, at each stage the researcher makes revisions and there is feedback at each stage.

The feasibility of the IPAS Learning Programme Development Results are 1) That the IPAS learning programme with the Understanding by Design (UbD) framework to Improve Concept Mastery and Problem Solving Ability is feasible to use as a process of material and learning process expert validation and linguist validation phase I and II. 2) Based on the results of teacher responses related to the IPAS learning programme with the Understanding by Design framework, it is feasible for learning reference materials and teachers can use the learning programme at any time. As well as IPAS learning students can increase motivation and interest in IPAS learning in getting to know the surrounding environment. And besides that, it is also equipped with a student module.

The effectiveness of the IPAS Learning Programme Development Results are 1) Before learning is carried out, researchers use IPAS Test Questions (Pretest and Posttest). The beginning of the pretest average with an average of 40 because some students have difficulty in mastering the concept, namely students still have difficulty understanding foreign words, and easily forget that has been discussed with the grade 4 teacher. Problem solving from grade 4 uses a problem solving learning model even though students are still confused to complete the learning. 2) After the implementation of IPAS learning. Based on the average posttest results got 71.06 from learning from researchers, students prefer learning using practice, mastery of concepts, namely students already understand the material that has been taught by researchers, students are very enthusiastic about learning.

Problem solving after being given treatment in IPAS learning, namely researchers using the model (PBL) in using this model is very effective and students become critical thinking in IPAS learning. Based on the results of pretests and posttests, researchers also use the normality gain test which aims to determine the treatment given.

Table 2. Pretest and Posttest Results

Pretest	Posttest	Criteria
40	71.06	Middle

Researchers used the formula and calculated the effectiveness test of gain normality according to Meltzer as follows (Meltzer, 2002)

$$\text{Gain Normality} = \frac{Spost - Spre}{Smaks - SPre}$$
$$= \frac{71,06 - 40}{100 - 40}$$
$$= \frac{31,06}{60}$$
$$= 0.51$$

Based on the table above, it can be seen that the trials on the Posttest and Pretest conducted by researchers on fourth grade students at SD Muhammadiyah 11 Semarang with an average Pretest score of 40, an average Posttest score of 71.06 after that it can be analysed through the Test of the effectiveness of Normality Gain according to Meltzer which results in 0.51. Therefore it can be concluded that the effectiveness of the development of the IPAS learning programme with the Understanding by Design (UbD) framework improves students' concept mastery and problem solving skills with "Moderate" criteria. This is in line with research from Siti Deti Nurhamidah, Atep Sujana, Dety Amelia Karlina (2022) with the title "Android-Based Media Development on Solar System Material to Improve Students' Concept Mastery Ability" with the results of the study so far the teacher only teaches using the lecture method, so that learning in the classroom becomes less interesting, less conducive, and students become less understanding of the material (Nurhamidah , Sujana, & Karlina, 2022). Based on data analysis compiled by researchers, it can be concluded that there are students experiencing an increase in concept mastery and problem solving by using the IPAS learning programme with the Understanding by Design (UbD) framework using the Problem Based Learning (PBL) learning model with the previous average pretest score of 40 and after being given using the IPAS learning programme with the Understanding by Design (UbD) framework to an average posttest score of 71.06.

The results of teacher and student responses to the IPAS learning programme are 1) From the teacher is that using the framework of Understanding by Design (UbD) get new knowledge, very good applied to the learning of IPAS in elementary school, UbD design is very interesting, equipped with PBL model makes student learning enthusiastic, and encourage students to think critically in solving problems in life, 2) From students, namely students get new learning experiences and knowledge, become fun, enthusiastic and more enthusiastic and active in learning IPAS.

CONCLUSION

The development of IPAS Learning Programme with Understanding by Design (UbD) framework using 5 stages of ADDIE development model has been developed and declared feasible by experts. The learning programme has also been equipped with modules and student activity sheets as tools in the IPAS learning process. The results of the effectiveness test of the IPAS Learning Programme with the Understanding by Design (UbD) framework show that the Normality Gain according to Meltzer which results in 0.51 with "Moderate" criteria. Response results from teachers and students showed that IPAS learning with the Understanding by Design (UbD) framework developed received a positive response.

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