

## **SUSTAINABILITY PEDAGOGICAL CONTENT KNOWLEDGE IN CASE OF BASIDIOMYCOTA MATERIALS FOR HIGH SCHOOL STUDENT MUST POSSESS IN LEARNING THAT SUPPORT SUSTAINABLE DEVELOPMENT**

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### **ABSTRACT**

To facilitate the implementation of learning that supports education for Sustainable Development, this paper intends to provide an example of a pedagogical knowledge content framework for learning using applicable curriculum materials. Furthermore, three aspects of sustainable development, namely social, economic and environmental, are embedded in the learning materials. In this article exemplified Basidiomycota for high school students. The framework uses systematic questions in the Content Representation (CoRe) instrument. There are 16 questions divided into 4 questions related to the breadth and depth of the material; three integrated aspects (social, economic and environmental) into the material are found in 7 questions; Next there are 5 questions related to pedagogy to teach the three aspects of sustainability that are embedded in the Basidiomycota material. With the help of the CoRe instrument, it produces learning by the teacher, namely basidiomycota material containing sustainability.

**Keywords: pedagogical content knowledge; CoRe; embedded; sustainability**

### **1 INTRODUCTION**

Issues such as climate change, loss of biodiversity, food security, healthy living, poverty, irresponsible consumption and production patterns are increasingly receiving global attention as urgent problems facing humanity. The United Nations has categorized those issues as a sustainability and has formulated the Sustainable Development Goals (SDGs).

The principles of sustainability first emerged in 1989 reported by the World Commission on Environment and Development, entitled *Our Common Future* which stated that activities to meet the needs of the present generation should not override the ability of future generations to meet their needs, emphasizing intergenerational equality and the interconnectedness of environmental, economic and social systems as the key to the concept of sustainability Purvis et al., (2019). Sustainability is a complex construction rooted in the concern for intergenerational equality and the balance of resource use and regeneration in the ecological field. Eventually, sustainability is a goal that will be achieved when human-caused environmental degradation, overconsumption and economic injustice eliminate the ability of the future generations to meet their needs (Nolet, 2009). The community is expected to be able to develop knowledge, understanding, skills, values, abilities and dispositions to respond to these complex problems.

Education is often seen as a central role in building society. In Indonesia, regarding to

education for sustainability, there is no special curriculum that accommodates sustainability in formal education. It is only a directive from the 2013 revision curriculum which one of the contexts in learning content was the Sustainability Development Goals (SDGs). The statement does not provide a more detailed explanation on how to develop it to become a learning material that is in accordance with the curriculum.

Within the framework of curriculum development that applies in Indonesia, which is the 2013 curriculum, there must be a learning planning document in accordance with the basic competencies that have been determined. Learning planning must be made by the teacher himself. Teachers and prospective teachers continue to train their abilities in designing learning, one of which is understanding Pedagogical Content Knowledge (PCK). It is known that PCK can facilitate effective teaching and learning in science education (Lehane & Bertram, 2016).

This paper focuses on the intersection between the concept of sustainability and the existing curriculum, so how can PCK integrate the concept of sustainability with curriculum materials, especially Basidiomycota material? The Basidiomycota material was chosen because it is a large group of fungi that can be seen with the naked eye, widely cultivated and widely used by Indonesian people for daily life such as food sources, cosmetics and medicine (Hiola, 2011; Khayati & Warsito, 2016; Wahyudi et al., 2016; Al Ulya et al., 2017; Lestari et al., 2018). This makes the Phylum Basidiomycota fulfil the social aspect, which is widely used for cultivation as a source of livelihood, the economic aspect is profitable because it becomes a source of income (Herremans & Reid, 2002; Sudrajat, 2018, Moreno-Camacho et al., 2019; Gu et al., 2019; Slarwamin et al., 2021), and environmental aspects, it is said that fungi in the forest act as decomposers (saprophytes) for dead plants and animals because they have hydrolase enzymes (Valadares et al., 2016; Sun et al., 2022; Berger & Ersoy, 2022 so that they can play a role in soil formation and fertility through the nutrient cycle (Taylor et al., 2015; Ernawati & Susanti, 2021; Susan & Retnowati, 2017) in addition, fungi are symbiotic with plant roots by forming mycorrhizae to help plant growth (Volk, 2013; Wahyudi et al.). The representation of sustainability PCK on Basidiomycota material is expected to provide new knowledge about PCK representation to integrate the concept of sustainability into materials according to the curriculum.

## 2 METHOD

This research is a descriptive qualitative research because this research represents pedagogical content knowledge (PCK) for the sustainability of the Basidiomycota material. In Indonesia, there is no specific curriculum to provide sustainable education, an understanding of the Sustainable Development Goals is only placed as one of the contexts in the material in the curriculum. Based on this, one way in implementing education for sustainability is to embed the concept of sustainability in the curriculum (Evans et al., 2017). In this article, it is presented that the concept of sustainability is embedded in the curriculum material.

In this article, the socio-cultural, economic and environmental aspects are integrated in the concept of the Basidiomycota material. PCK representation for learning material Basidiomycota, using a concept that has been developed by (Mulhall et al., 2003; Loughran et al., 2012) known as Content Representation (CoRe). CoRe is related to certain materials that focus on describing the teacher's understanding of the aspects that represent and shape the material.

CoRe in this article is the teacher's perspective on the Basidiomycota material that will be taught to students by adding a sustainability mindset. The CoRe component developed in this article is a modification of the CoRe developed, which consists of seven questions taken from Loughran et al., (2012) and nine questions to represent the concept of sustainability in the Basidiomycota material. The sixteen questions are as follows: (1)What should students master about this concept?

(2) Why is the concept important to students? (3) Regarding this concept, what concept do you think is not the time for students to know yet? (4) What difficulties or limitations might you experience in teaching the concept? (5) What conditions/characteristics of students (initial knowledge/way of thinking/interests) are you considering in teaching this concept? (6) Use/selection of context: personal/local/national/global to provide an understanding of the idea? (7) How is the embedding of socio-cultural aspects in this concept? (8) How is the embedding of the economic aspect in this concept? (9) How is the embedding of environmental aspects in this concept? (10) How will you take advantage of existing technology in teaching the concept of macro Basidiomycota charged with sustainability? (11) How will you achieve the goal of teaching the concept of sustainability-charged macro Basidiomycota with the absence of technology facility? (12) What is the teaching procedure/sequence/flow you chose to teach the concept of macro Basidiomycota charged with sustainability and its particular reasons? (13) How do you know whether students understand or not? (14) What activities in learning in order to maintain the existing Green conditions? (15) What are the activities in learning in order to prevent Green condition so that there is no disturbance? (16) What activities in learning in order to build the existing Green conditions to be more sustainable? Furthermore, it is ar-ranged as in Table 1 below.

Table 1. Content Representation for Sustainability Pedagogical Content Knowledge

| Questions  | Big Ideas |   |   |   |   |
|--|-----------|---|---|---|---|
|  | 1         | 2 | 3 | 4 | 5 |
| 1. What should students master about this concept?   |           |   |   |   |   |
| 2. Why is the concept important to students?   |           |   |   |   |   |
| 3. Regarding this concept, what concept do you think is not the time for students to know yet?   |           |   |   |   |   |
| 4. What difficulties or limitations might you experience in teaching the concept?  |           |   |   |   |   |
| 5. What conditions/characteristics of students (initial knowledge/way of thinking/interests) are you considering in teaching this concept?       |           |   |   |   |   |
| 6. Use/selection of context: personal/local/national/global to provide an understanding of the idea?   |           |   |   |   |   |
| 7. How is the embedding of socio-cultural aspects in this concept?   |           |   |   |   |   |
| 8. How is the embedding of the economic aspect in this concept?  |           |   |   |   |   |
| 9. How is the embedding of environmental aspects in this concept?  |           |   |   |   |   |
| 10. How will you take advantage of existing technology in teaching the concept of macro Basidiomycota charged with sustainability?               |           |   |   |   |   |
| 11. How will you achieve the goal of teaching the concept of sustainability-charged macro Basidiomycota with the absence of technology facility? |           |   |   |   |   |

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|--|
| 12. What is the teaching procedure/sequence/flow you chose to teach the concept of macro Basidiomycota charged with sustainability and its particular reasons? |
| 13. How do you know whether students understand or not?  |
| 14. What activities in learning in order to maintain the existing Green conditions?  |
| 15. What are the activities in learning in order to prevent Green condition so that there is no disturbance?   |
| 16. What activities in learning in order to build the existing Green conditions to be more sustainable?  |

### 3 RESULTS AND DISCUSSION

PCK representation in the form of Content Representation (CoRe). Content Representation of PCK in the form of Content Representation (CoRe), usually written in tabular form to holistically describe PCK related to teaching of a specific topic, namely the Basidiomycota. The material representation of Basidiomycota consists of 5 big ideas/big concepts, presented in Table 2. Content Representation in the form of a matrix, big idea or essential concept about a particular topic at the head of the columns and a set of pedagogical questions for each row.

Table 2. Content Representation for Sustainability Pedagogical Content Knowledge A Case of Basidiomycota

| Questions  | Big Idea   |  |   |  |  |
|--|--|--|---|--|--|
|  | Characteristic of Basidiomycota  | Structure of Basidiomycota   | Reproduction of Basidiomycota   | Classification of Basidiomycota  | The role of Basidiomycota  |
| 1. What should students master about this concept? | Characteristics of Macro Basidiomycota: <ol style="list-style-type: none"> <li>1.It is a filamentous organism made of a collection of hyphae (Bentil, 2021)</li> <li>2.It has a large basidiocarp (Volk, 2013) so that it can be observed</li> </ol> | The structure of macro Basidiomycota is shaped like an umbrella which consists of parts, namely the hood (cap or pileus), blades (lamella), fruit stalks (stape or stalk), rings (annulus) (Taylor 2009)           The | The life cycle of Basidiomycota is sexually and asexually reproductive. Sexual reproduction is produced by basidiospore. Otherwise, asexual reproduction is created by conidiospores. | Classification of Basidiomycota: according to the species cultivated by mushroom farmers include: Pleorotus (oyster mushroom), Agaricus bisporus (button mushroom), Volvariella volvacea (merang | Classification of Basidiomycota: according to the species cultivated by mushroom farmers include: Pleorotus ostreatus (oyster mushroom), Agaricus bisporus (button |

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|---|--|--|--|---|
| with the naked eye (Tang, 2018) and can be held or picked by hand (Nasution, 2018)  | reproduction structure is in the form of blades (gills) located on the lower surface of the umbrella or hood (Bentil, 2021). | (Palmer and Horton , 2006) It is also descriptively informed by Taylor 1993, Kues 2000, Halbwachs, 2015, Bentil, 2021) | mushroom), Auricularia auricula-judae, A. polytricha (ear mushroom), Lentinula edodes (shitake mushroom), Calocybe indica (milk mushroom) . Divisio Basidiomycota is divided into 3 subdivisios or subphylums namely Agaricomycotina which consists of 3 classes, Pucciniomycotin a which consists of 8 Classes, and Ustilaginomycotina which consists of 3 Classes. Classification is carried out according to the order of classification: Divisio Subdivisio Class Subclass Order Famili Genus (Brondz, 2014, Yang 2011). Swan 1995, Blackwell 2004 mention 3 Classes: hymenomycetes, ustilaginomycetes and | mushroom), Volvariella volvacea (merang mushroom), Auricularia auricula-judae, A. polytricha (ear mushroom), Lentinula edodes (shitake mushroom), Calocybe indica (milk mushroom) . Divisio Basidiomycota is divided into 3 subdivisios or subphylums namely Agaricomycotina which consists of 3 classes, Pucciniomycotina which consists of 8 Classes, and Ustilaginomycotina which consists of 3 Classes. Classification is carried out according to the order of classification: Divisio Subdivisio Class Subclass Order Famili Genus (Brondz, 2014, Yang 2011). |
| 3.Basidia (singularly called basidium) are shaped like a mace, which is a terminal cell enlarged from hyphae (Bentil, 2021) |  |  |  |   |
| 4.It has a basidium during meiosis which contains meiospores. These spores are called basidiospores (Desjardin 2004).       |  |  |  |   |
| 5.Saprophyte is mostly the way of its living  |  |  |  |   |
| 6.It has a habitat in a humid area  |  |  |  |   |

urediniomycetes. Swan 1995, Blackwell 2004 mention 3 Classes: hymenomycetes, ustilaginomycetes and urediniomycetes.

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| 2. Why is the concept important to students?   | Able to distinguish the special characteristic of macro Basidiomycota from other divisio | Able to distinguish the structure of macro Basidiomycota from other divisio   | Connecting between body structure and reproductive function; and for cultivation (inoculation of fungal spores on the growing medium)   | Having deeper understanding about the differences and similarities of macro Basidiomycota | Providing meaningful knowledge to solve problems in students' daily lives, including sustainability |
| 3. Regarding this concept, what concept do you think is not the time for students to know yet? | No need to learn about genetics or genome traits   | It must be complete. Everything must be shown from the fruit body to the basidiospore but there is no need to know about how to regulate the physiology of growth / formation | It must be shown completely about sexual and asexual reproduction. There is no need to know about regulation of reproductive physiology | Classification of divisio to species (only for macro-sized and edible species)            | Only those who act as decomposers and as foodstuffs to meet the concept of sustainability           |
| 4. What difficulties or limitations might you experience in teaching the concept?              | Cannot show all the characteristics with direct/real objects.                            | In general, the existing learning resources do not include size and extremely small sections cannot be shown directly /concretely   | Cannot show all stages with direct/real objects.  | Cannot show all instances of species with direct/real objects.                            | Cannot show all species with direct/real objects relating to their role.                            |
| 5. What conditions/characteristics of students (initial  | Local as it is found a lot around students   | Local as it is found a lot around students  | Local as it is found a lot around students  | Local as it is found a lot around students  | Local as it is found a lot around students  |

|    |   |   |  |  |   |   |
|----|---|---|--|--|---|---|
|    | knowledge/way of thinking/interests) are you considering in teaching this concept?                |   |  |  |   |   |
| 6  | Use/selection of context: personal/local/national/global to provide an understanding of the idea? | The characteristic of macro Basidiomycota on a cultivation activity | The body structure of macro Basidiomycota macro on a cultivation activity  | How to reproduce macro Basidiomycota at a cultivation activity | Classification of macro Basidiomycota in a cultivation activity | Fungus cultivation macro Basidiomycota for food security and a good source of nutrition (El-Ramady, 2022)   |
| 7. | How is the embedding of socio-cultural aspects in this concept?                                   | -   | The result of cultivation of mushrooms for the source of family income that are worth selling; the difference in selling value is based on size and shape. | -  | -   | The cultivation of macro Basidiomycota mushrooms as a source of income (reducing poverty) (Grimm, 2018) and students analysis of additional opportunities of mushroom farmers' income from the results of making organic fertilizers from spent mushroom substrates |
| 8. | How is the embedding of the economic aspect in this concept?                                      | -   | -  | -  | -   | Based on the literature, students designed the use of Spent Mushroom Substrate (SMS) for the manufacture of organic   |

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|  |  |  |   |   | fertilizer for plants; spent mushroom substrate for other macro Basidiomycota mushroom substrates so it can build a good environment   |
| 9. How is the embedding of environmental aspects in this concept?  | Having preliminary understanding about division of fungi and having the same pattern of thinking when discussing characteristics     | The structure of the macro Basidiomycota is effortless to see and easy to understand because it is macroscopic | Preliminary knowledge has been obtained about division of fungi                                   | Classification is carried out in the same way as the previous division of fungi to species  | Students can easily find out about the role of Basidiomycota such as foodstuffs and decomposers  |
| 10. How will you take advantage of existing technology in teaching the concept of macro Basidiomycota charged with sustainability? | A number of features (4 characteristics) of macro Basidiomycota is written using digital text in complete images using power points  | Digital picture of macro Basidiomycota's structure equipped with image captions with digital text              | Videos from Youtube with digital text about reproduction of macro Basidiomycota using power point | Classification of digital text based on the characteristic and structure of macro Basidiomycota equipped with digital images using power points | Sustainable merang mushroom cultivation (seen from social, economic and environmental integrated aspects) using video modifications from Youtube and equipped with explanations digital text |
| 11. How will you achieve the goal of teaching the concept of sustainability-charged macro Basidiomycota with the absence of        | A number of characteristics (4 traits) of Basidiomycota macros are written in the form of printed text equipped with printed picture | Printed image of macro Basidiomycota structure equipped with image caption                                     | Print image about reproduction of macro Basidiomycota equipped with printed text                  | Printed text on classification based on the characteristic and structure of macro Basidiomycota macro with printed images                       | Printed images of sustainable merang mushroom (seen from social, economic and environmental integrated aspects) and  |



|  |   |  |   |   |  |
|--|---|--|---|---|--|
| technology facility?   |   |  |   |   | equipped with printed text   |
| 12. What is the teaching procedure/sequence/flow you chose to teach the concept of macro Basidiomycota charged with sustainability and its particular reasons? | Using the Project Based Learning model guided by the Student Activity Sheet: students design a project to find the macro Basidiomycota features of a cultivation activity then present them in the form of a video. | What is the teaching procedure/sequence/flow you chose to teach the concept of macro Basidiomycota charged with sustainability and its particular reasons?   | Using the Project Based Learning model guided by the Student Activity Sheet: students design a project to find the macro Basidiomycota features of a cultivation activity then present them in the form of a video. | What is the teaching procedure/sequence/flow you chose to teach the concept of macro Basidiomycota charged with sustainability and its particular reasons?                                      | Using the Project Based Learning model guided by the Student Activity Sheet: students design a project to find the macro Basidiomycota features of a cultivation activity then present them in the form of a video.  |
| 13. How do you know whether or not students understand?  | Quantifying students' understanding using multiple-choice question which describes the 4 characteristics of the macro Basidiomycota fungus  | Quantify students' understanding using multiple-choice question and students' investigation video on mushroom cultivation which is shown the adult macro Basidiomycota mushrooms and is seen clear parts (given captions or sounds which explaining parts of the structure of the macro Basidiomycota fungus | Measuring student comprehension using multiple-choice questions and essays which students can explain a complete systematic stages of sexual and asexual reproduction with images                                   | Quantify students' understanding using multiple-choice question and essays which students can classify based on results of identifying the characteristics and structure of macro Basidiomycota | Measuring students cognitive understanding using multiple-choice question about several roles for health, food, and the environment. Students' understanding is measured by assessing the products produced by students, the concept of sustainability in the cultivation of macro Basidiomycota mushrooms |
| 14. What activities in learning in order to maintain the existing Green conditions?  |   |  | -   |   |  |

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15. What are the activities in learning in order to prevent Green condition so that there is no disturbance? -
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16. What activities in learning in order to build the existing Green conditions to be more sustainable? Building a useless thing becomes useful one: the waste of the mushroom growing media can be used to plant fertilizer and the planting medium for other species of Basidiomycota mushrooms which can increase the income of mushroom farmers and improve environmental quality.
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The teacher's PCK sustainability can be seen from its ability to develop concepts that are considered important by teachers, the ability to describe important concepts and the ability to embed the concept of sustainability (social, economic and environmental aspects that are integrated with an understanding of activities in the social field that must be profitable but should not damage the environment) in these important concepts then choose the right pedagogy to teach it.

The PCK representation of the sustainability of the Basidiomycota material that has been described in Table 1 shows that the ability to master the Basidiomycota concept can be seen from the selected big idea/essential concept. The selected essential concepts, namely characteristics, body structure, reproduction, classification and roles in human life are in accordance with the demands of the curriculum in Indonesia (Menteri Pendidikan dan Kebudayaan Republik Indonesia, 2018) in biology class of the first-year high school students in the domain of knowledge competence which is grouping fungi based on their characteristics, ways of reproduction, and linking their roles in life; and also in accordance with the competence of the psychomotor domain, that is presenting reports on the results of investigations on the diversity of fungi and their role in life. (Lankford, 2010; Hume & Berry, 2011; Yanti et al., 2020) informed that in determining the chosen idea, it must be in accordance with the applicable curriculum. This has been seen in the selection of the selected big idea/essential concept, the explanation is as follows, it is known that Kingdom Fungi have 6 Phylum namely Phylum Basidiomycota, Phylum Ascomycota, Phylum Glomeromycota, Phylum Blastocladiomycota, Phylum Chytridiomycota, and Phylum Neocallimastigomycota (Money, 2016). Otherwise, according to (Richards et al., 2012) there are 4 Phylum, namely Phylum Basidiomycota, Phylum Ascomycota, Phylum Zygomycota and Phylum Chytridiomycota. However, in this article only discussed about the Phylum Basidiomycota, especially represented by the macro Basidiomycota because the macro Basidiomycota is the largest member of the Phylum Basidiomycota, it is easy for students to see and learn from cultivation activities; Likewise, the sequence of big ideas/important concepts starting from an understanding of the characteristics, structure, reproduction, classification and role in human life is in accordance with the statements in the Basic Competencies. Characteristics, structure, reproduction, classification and role in human life are big ideas/important concepts in learning to understand about fungi (Science, 2017; Moore et al., 2005; Zhang et al., 2010; Meneghetti et al., 2017).

Furthermore, knowledge in describing or outlining each big idea/important concept can be seen from the answers to questions in the CoRe instrument. Questions number 1, 2, 3 and 4 relate to the depth and breadth of the material in accordance with the demands of Basic Competence. The material description of each essential concept of the characteristics, structure, reproduction, classification and role of fungi is taken from the Fungal Biology High School Learning Module in 2020 published by the Ministry of Education and Culture, and uses the journal articles mentioned in Table 1. There is an expansion of the concept to make it easier for students to understand Basidiomycota mushrooms compared to just relying on the descriptions listed in the Module.

The teacher's knowledge of embedding the concept of sustainability in three integrated aspects (social, economic and environmental) into the macro Basidiomycota material is found in the answers to questions number 5, 6, 7, 8, 14, 15 and 16 as follows: Selected context that fits the material The specific subject is the cultivation of Basidiomycota mushrooms. The context of Basidiomycota mushroom cultivation is used by students to find Basidiomycota material according to the curriculum, namely characteristics, structure, reproduction, classification and roles in human life. In the social aspect, it is embedded in the discussion of the material characteristics, namely that mushroom farmers carry out cultivation activities according to the characteristics of saprophytic mushrooms, then use planting media in the form of residual organic matter from straw, sawdust; and if the conditions are humid, the temperature and humidity of the room and the growing media must be regulated, have filaments and have meiosis, the planting media must be adjusted so as to allow the spores to germinate and the filaments to grow well. Social aspects are also embedded in the reproductive material of fungi, namely the cultivation of sowing spores on the growing medium, then a mycelium is formed, a button appears until an umbrella-shaped fruiting body structure is seen (Pitjeng-Mosabala & Rollnick, 2018; Taylor et al., 2009). The social aspect is also embedded in the mushroom classification material, that in mushroom cultivation activities, mushroom farmers must determine the type or species of mushroom being cultivated. The role of Basidiomycota is also part of the social aspect, namely the cultivation of Basidiomycota mushrooms is a human activity to obtain nutritious food and medicine for health. (United Nations Educational scientific and cultural organization, 2005; Rieckmann, M. Mindt, L. and Gardiner, 2017; Gnansounou & Pandey, 2017; Mikalauskiene et al., 2018) mentions that food security, agriculture and health are social aspects.

In the economic aspect, the structure and reproduction of the Basidiomycota material, it is known that the cultivation of Basidiomycota mushrooms can be profitable so that it becomes a source of income (Gu et al., 2019; Martínez-Ibarra et al., 2019). The income of Basidiomycota Macro mushroom farmers is obtained at harvest when the mushrooms have an umbrella-shaped structure consisting of parts, namely the hood (cap or pileus), blade (lamella), fruiting body stalk (stipe or stalk), ring (annulus). Environmental aspects are embedded in the role material when mushroom growing media is beneficial for the environment because it uses waste in the form of wood saws made in the form of baglog (Gu et al., 2019). Then the baglog waste is reused for plant fertilizer and planting media for other fungi Kulshreshtha (2021), which in the process uses Basidiomycota mushrooms (Gu et al., 2019; Gowda N.A et al., 2021).

The pedagogy to teach the concept of sustainability embedded in the Basidiomycota material can be explained in the answers to questions 9, 10, 11, 12 and 13 in the CoRe instrument. The Problem Based Learning model starts with choosing a project topic, pre communicative activities, asking essential questions, designing a project plan, creating a project timeline, finishing the project, assessing the project results, and evaluating the project (Hamidah et al., 2020).

Students have projects to solve challenging problems on the topic of real-world problems (Grant, 2002; Goodman & Stivers, 2010; Dias et al., 2017) that occur in the cultivation of Basidiomycota mushrooms. The challenging activity in this Project Based Learning model is an exploration-based activity in the cultivation of Basidiomycota mushrooms, with the first problem being how the cultivation of Basidiomycota mushrooms can produce products that are useful for food, health, and can be used as a source of income, explained with supporting evidence. The second problem is how the cultivation activities do not produce waste that can cause negative impacts on the environment and describe the answers along with the waste handling products. The answers to questions from the mushroom cultivation case are presented in the form of a video as information for farmers and the community to understand. Cultivation of macro Basidiomycota mushrooms such as oyster mushrooms, straw mushrooms, button mushrooms and so on. It is known that Basidiomycota mushroom cultivation uses spent mushroom substrate. Spent mushroom substrates can cause environmental pollution, therefore action must be taken not to damage the environment.

#### 4 CONCLUSION

Sustainability pedagogical content knowledge in the Basidiomycota material produced using the CoRe instrument, it appears that three aspects of sustainable development are embedded in the Basidiomycota material. Using the Project based learning model with the context of Basidiomycota mushroom cultivation was constructed to find the characteristics, structure, classification and reproduction through fungal plant activities (social aspect); the social aspect is also seen in the role of mushrooms as food ingredients that contain good nutrition for human health; the concept of the structure of Basidiomycota mushrooms was also found through mushroom harvesting activities which were associated with the income of mushroom farmers (economic aspect); and realizing a role for Basidiomycota to process spent mushroom substrate into fertilizer, as well as substrate for other fungi (environmental aspect).

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