**Tables and Figure**

**Fig. 1.** Individual Distribution of LSRT Pre-Test Post-Test Scores

Points

**Fig.2.** Individual Distribution of SPST Pre-Test Post-Test Scores

points

**Table 1.** The contents of the activities

|  |  |
| --- | --- |
| Activity Name | Activity content |
| Extraterrestrial Habitat | In this activity, students were presented with a problem scenario regarding the effects of global energy demand as a result of the decrease in fossil fuels. The students had group discussions on the conditions necessary to establish a living space on a planet other than Earth then made individual researches and shared their solution proposals on the digital board and prepared presentations. |
| How to Live on the Moon? | In the activity, the students were given a problem scenario about a habitat to be established on the Moon for space exploration. Students put themselves in the position of an engineer working at NASA, they did research on the atmosphere on the Moon, surface properties, temperature differences, weather events, distance from the Earth and had group discussions on solution proposals. |
| A Renewable Energy Source: Solar Energy | A problem scenario related to the use of solar energy and energy conversion was given to the students. The students examined the interaction of the radiometer with the light, they tried to predict how the mechanism inside the radiometer moved, then they determined the hypothesis, dependent variable and independent variables by designing an experiment on the amount of light energy absorption due to the colors of the materials and shared the experiments they designed with their groupmates. |
| Build Solar Panels on the Moon | A problem scenario was presented to the students for the installation of solar panels to meet the energy needs of a base established on the Moon within the scope of space exploration. After defining the problem, the students held discussions about the solution, made individual researches on the subject, and prepared presentations containing solution suggestions by considering factors such as the gravitational force of the Earth and Moon, surface shapes and temperature values. |
| Space Explorations and Vitality | Presented to students a problem scenario of yeast overgrowth for a researcher to study the vitality and energy state on a planet other than Earth. After defining the problem, the students were asked to have a group discussion for the solution and to do research on the subject. Students designed an experiment based on the research results, identified the hypothesis, dependent variable, independent variable, and control variables, performed their experiments as a group and interpreted the results. |
| Yield of Solar Panel Fields | In this activity, the students were presented with a problem scenario regarding the efficiency of the panels in obtaining energy from solar panels and they were allowed to have group discussions on the solution of the problem. According to the activity instructions, the students first evaluated the geometric structure of the panels, the angle of the sun, the inability to get sunlight at night and offered solutions, they designed and presented a solar energy panel. |

**Table 2.** t-Test Results of LSRT Pre-Test Post-Test Values

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **X** | **Sd** | **df** | **t** | **p** |
| Pre-Test  Post-Test | 9  9 | 3.33  5.11 | 1.41  1.83 | 8 | -3.60 | .007 |

**Table 3.** t-Test Results of SPST Pre-Test Post-Test Values

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **X** | **Sd** | **df** | **t** | **p** |
| Pre-Test  Post-Test | 9  9 | 14.89  19.78 | 4.42  3.49 | 8 | -7.02 | .000 |

**Table 4.** Students' Opinions on Activities Obtained from Reflective Diaries

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Theme | Statement | Act.1 (f) | Act.2 (f) | Act.3 (f) | Act.4 (f) | Act.5 (f) | Act.6 (f) |
| Favorite Directions | find a solution to the problem | - | 4 | - | - | - | - |
| research | 2 | 1 | - | - | - | - |
| presentation | 1 | - | - | - | - | 3 |
| reasoning | 1 | - | - | 1 | - | - |
| identifying needs | 3 | 1 | - | - | - | - |
| discussion | - | 1 | 2 | 3 | - | 3 |
| experiment | - | - | - | - | 5 | - |
| observation | - | - | 4 | - | 4 | - |
| estimate | - | - | 2 | - | - | - |
| learning new things | - | - |  | 3 | - | - |
| all of them | 2 | 2 | 1 | 2 | - | 3 |
| Dislikes | material selection | - | 1 | - | - | - | - |
| limited time | 1 | - | - | - | - | 1 |
| difficulty | - | - | 1 | - | - | - |
| extraterrestrial life | - | - | - | 1 | - | - |
| none | 8 | 8 | 8 | 8 | 9 | 8 |
| Skill Acquisition | thinking skill | 5 | 4 | 3 | 4 | 2 | 3 |
| reasoning | 3 | 2 | 4 | 2 | 4 | 3 |
| problem solving | - | 1 | - | - | - | - |
| mental skill | - | - | 2 | - | - | - |
| estimate | - | - | - | 1 | - | - |
| experimentation | - | - | - | - | 2 | - |
| designing | - | - | - | - | - | 2 |
| research | 1 | 2 | - | - | - | 1 |
| unknown | - | - | - | 2 | 1 | - |

**Table 5.** Codes Regarding Opinions on the Theme of Instructional Design

|  |  |
| --- | --- |
| **Codes** | **Student** |
| Intriguing | S2, S3 |
| Interesting | S1, S2, S3 |
| Enjoyable | S1, S5, S6 |
| Encouraging to research | S2, S3, S4 |

**Table 6**. Codes Regarding the Opinions Regarding the Difficulty Level of the Study

|  |  |
| --- | --- |
| **Codes** | **Student** |
| Not challenging | S2, S6 |
| Some parts are challenging | S1, S3, S4 |
| Challenging and motivating | S1, S3, S5 |

**Table 7**. Codes Regarding Opinions on PBL Scenarios

|  |  |
| --- | --- |
| **Codes** | **Student** |
| It's fun to work on the problem | S1, S2, S3, S4, S5, S6 |
| Trying to solve the problem improves thinking skills | S3, S4 |
| It's fun to design for the solution of the problem | S2, S3 |

**Table 8**. Codes Regarding the Opinions Regarding the Contribution of the Work to Daily Life

|  |  |
| --- | --- |
| **Codes** | **Student** |
| Developing problem solving skills | S1, S4 |
| Desire to research events encountered in daily life | S2, S3, S5 |

**Table 9**. Codes Regarding the Opinions on the SPS Achievement of the Study

|  |  |
| --- | --- |
| **Codes** | **Student** |
| Hypothesize | S1, S3, S6 |
| Identifying variables | S3, S4, S6 |
| Observing | S1, S5, S2, S6 |
| Experiment | S1, S4, S6 |

**Table 10**. Codes Regarding Opinions Regarding the Contribution of the Study to Reasoning Skills

|  |  |
| --- | --- |
| **Codes** | **Student** |
| Thinking of ways to solve a problem | S1, S2, S3, S4, S6 |
| Developing a design for the solution of the problem | S1, S3, S5, S6 |
| When designing an experiment | S2, S6 |

**Table 11**. Codes Regarding Opinions Regarding Group Work

|  |  |
| --- | --- |
| **Codes** | **Student** |
| I prefer group work | S1, S2, S5 |
| Sometimes I prefer to work with a group, sometimes individually. | S3, S4 |
| It is useful to exchange ideas as a group. | S1, S2, S3, S4, S5 |
| Collaboration and work sharing makes study easier | S2, S4 |

**Table 12**. Codes Regarding the Views Regarding the Blended Learning Environment

|  |  |  |
| --- | --- | --- |
| Positive aspects | **Codes** | **Student** |
| Ease of access to course documents | S1, S2, S4, S5 |
| Working independently of time and place | S2, S3, S4, S5 |
| Negative aspects | Internet access problem | S1, S2, S4, S5, S6 |
| Limited experimental studies | S1, S6 |
| Inability to socialize | S2, S3 |