

## USE OF PEER EVALUATION FOR LEARNING OF SCIENTIFIC CONCEPTS THROUGH GAMES

### **ABSTRACT**

For evaluation of science learning in classroom, innovative method of arranging games by students of 8<sup>th</sup> standard, called as Game conducting Group (“GCG”) for 7<sup>th</sup> standard (“Test Group”) was implemented. Total planning time was two months, & in this time discussions, brain storming, selection of games, discussion with each group separately, checking of the games, checking of evaluation scheme of each group, game set up, problem solving, etc.; were conducted. Total Time of activity was 5 hrs. This is practical based activity.

**Keywords:** Peer evaluation, scientific content, games, resources, application of concepts

**Subtheme:** Evaluation of problem solving ability

### **Introduction:**

Activity based learning (ABL) is widely considered to be innovative and effective teaching practice. Many kinds of activities expounding a plethora of concepts are embedded in any curriculum. A short summary of advantages and disadvantages of ABL may be presented as follows:

ABL is advantageous because 1) Learning in this manner has a longer life in memory – a performed task will be remembered better than a retained description of the same; 2) One can use a more diverse set of instructions than one to many teaching interactions; 3) due to active involvement, learners engage for a longer duration as compared to classroom environment; 4) Many transferable skills get developed as peripheral learning and 5) interpersonal skills may get involved if the activity involves teamwork.

However, arranging or demonstrating all the activities is a cumbersome task for a teacher who teaches more than 30 students in her class. Also, students and teachers might have to prepare much before the activity and post processing of the activity is also time consuming. Objective evaluation may not happen of the activity.

Bearing all of the above in mind, a simple experiment was set up in Jnana Prabodhini Navanagar Vidyalaya for 7 and 8 graders. In the philosophy of education as practised at Jnana Prabodhini, student initiative is always valued highly. Students are always encouraged to take initiative for their own learning. Apart from this common practice, many activities of Jnana Prabodhini expect the students to take *lead* in learning of their peers as well as juniors. It enables them to become not just *active participants*, but *initiators and leaders* of the action itself.

In tune with this philosophy, I asked 8<sup>th</sup> graders to design one game each, which would be based on the curriculum of science and would be played by 7<sup>th</sup> graders. The objectives of the enterprise were twofold: 1) 7<sup>th</sup> graders (“Test Students”) would get the benefit of learning in ABL style, they would be able to relate the concepts they learn in the class with some practical application, and 2) 8<sup>th</sup> graders (“Games Constructing Group” or “GCG”) would get the opportunity to engage their creativity foreducation of their juniors.

The process went as elucidated henceforth:

1. **Introduction:** In the first discussion with students, I gave all of them an idea about the activity & nature of games.

2. **Brainstorming:** Generation of ideas in brain storming sessions:
  - a. Each student gave 8 to 10 ideas.
  - b. They were collected together and after processing for removal of repetitions and feasibility, initially 30 ideas were selected.
  - c. Finally, 15 ideas were short listed for the event.
  - d. For e.g. snake & ladder, memory game, spin wheel, concentration, puzzles, light on right, crossword, name the principles, craft from trash, food chain, in general.
3. **Designing:** Students developed, in due consultation with teachers, required material for their games, decided upon the marking schemes and generated model answers.
4. **Conducting of the games:** A convenient day was chosen and GCG were allotted spots at a suitable place. Test students would visit these spots one by one. In all, 15 spots were opened for test students. Teacher simply supervised overall conduct at place and made qualitative observations.

A table stating the name of the game and concepts that were targeted is presented below:

No.	Name of Game	Concepts	Test
1	Spin jack pot	Vitamin and diseases	K
2	a) Concentration b) Simple machine	Completion of electrical circuit Uses of simple machine	S SK
3	Classification	Classification of object as metals& non-metals, renewable non-renewable, magnetic non-magnetic	K
4	Spin wheel	Scientists and their inventions <b>Magnet and coin properties of the magnet</b>	K
5	Acid and base	To identify acidic, basic or neutral substances in our daily routine. (e.g. hand wash, oil, spinach extract)	A
6	Snakes and ladder	Molecular formulae and symbols	K
7	Tinkering	Use of different concepts and ideas while playing games.	A
8	Laser mirror path	Multiple reflection	A
9	Apparatus	To identify lab apparatus and write their uses	K
10	Classification	Conductor & insulators	K
11	Science behind the magic	Compression of air	A
12	Magnet car puzzle	Different questions from science	K
13	Puzzles	Food chain, digestive system, respiratory system	K
14	Cross word puzzle	Based on syllabus	K
15	Mirror reflection	Number of images formed by reflection by two plane mirrors at different angles.	A

Detailed explanation of two of the fifteen games follows:

**Game One: Laser Mirror Path**

**Level 1** : On a card board, path of 4 zig zag lines are drawn. Students were provided with small mirrors. Laser source was kept fixed. Students were expected to adjust the mirrors so that Laser should travel the marked path & reach the destination point.

**Level 2** : Mirrors were required to be adjusted such that the laser should follow the complex path of 6 zig zag lines.



**Marking System :**

Level 1 – time given to set mirrors – 1 min 30 sec. Each Line – 1 mark, total 4 marks.

Level 2 – time given to set mirrors – 1 min 50 sec. Each Line – 1 mark, total 6 marks.

**Game Two: Images formed in 2 plane mirrors at different angles.**

Two plane mirrors were given to students. Students were asked to adjust the mirrors at angles 30°, 60°, 90° etc. Students were supposed to count the no. of images formed in mirrors.

Students were required to fill up following table.

Sr.	Angle	No. Of images
1		
2		
3		
4		



No of images =  $\frac{360}{\text{ANGLE}} - 1$

**Marking System:**

Each Angle - 2 marks – Total 8 marks for angle Formula – 2 marks, Total – 10 marks

**A Note:** While many games test mainly memory or knowledge, the competitive spirit developed at the time of the activity itself is conducive for students to memorize many concepts in their textbooks. Two games tested for skill, five games tested Application of knowledge to some extent while other games mainly tested knowledge. A suitable mixture of such games will evolve over the years. The choice of the games, design or concepts was not forced upon the students, as I did not want to initiate any action that would be counterproductive to their enthusiasm. Whatever flowed from mutual discussion was accepted.

**Evaluation of Test Students:**

Evaluation of all test students, thus ensured upon quite **objective parameters**, performed by GCG, is accepted in their annual evaluation. All students had to play all the games in prescribed time-limit ensuring that there was no skewness in their evaluation.

A sample report for one student is appended in Appendix 1.

Apart from this objective evaluation, I noted the following:

1. Students were happy, curious & enthusiastic to play the games. All students from 7<sup>th</sup> class participated with their own interest in games.
2. The students played the games well & understood the scientific concepts behind the games properly as reflected from their marks.
3. The students completed games & were eager to know the marks.
4. Test students got marks ranging from 100 to 180 out of 217.
5. They were asking questions about new concepts. Trying to get answers to their wrong answers.

### **Evaluation of GCG:**

As regards the GCG, they were evaluated on following parameters, justification for inclusion of which, is given as under:

1. **Choice of scientific concept:** This gives idea about the thinking ability of the student from GCG group. We can check whether he is trying to generate his own idea other than regular syllabus or same which we are taking in the school.
2. **Process of arranging the game:** in this, following points are checked
  - a) No. of discussions with teacher or guide
  - b) Use of resources
  - c) Questions raised during discussions
  - d) Efforts taken to make the game innovative
  - e) Helping nature
  - f) How he tackles the problem
3. **Simplicity of the game:** If GCG student understands the concept correctly and able to explain it to others then he will be able to arrange the game in simple manner. We can check whether he is able to convey his idea in simple manner to others.
4. **Level of the game:** we can check the knowledge of the student in different areas and Proper use of resources.
5. **Innovation:** To check how differently GCG student can arrange the game so that the scientific concept is understood to test students.
6. **Depth of knowledge:** this evaluation parameter is considered to check overall awareness regarding the concept presented. Also this parameter is used to gauge knowledge of GCG student in other games also.
7. **Creativity:** This parameter helped to check how GCG student can apply his knowledge to present the game creatively. Sometimes students have knowledge but are not able to present it.
8. **Impact of game:** when test students played the game with full interest and understood the underlying scientific principle of the game it created a positive impact of the game. Impact of game included simplicity of game presentation, ease of playing game, and explanation by GCG student.
9. **Team work:** to conduct any group activity work management, distribution of work, and completion of the work in given time, to help other group members to complete their work. Unity to solve any problem all these parameters are important. Focus should be the completion of work in proper manner.
10. **Evaluation scheme:** As per the game pattern GCG students had to decide their evaluation scheme. Proper evaluation scheme explains that GCG students have understood their game and scientific concept of the game.

A sample report for four students is appended in Appendix 2.

Apart from this parameterized evaluation, I noted the following:

1. GCG students developed a number of evaluation methods for their experiments.

2. Students from GCG can set up lab experiments easily.
3. We can judge the ability of both the groups.  
GCG group: ability to present the concept  
Test group: ability to understand the concept

**Future Scope:**

1. One new evaluation tool will be developed, progressively.
2. Understanding of the concepts can be checked for both the groups. (TEST & GCG) by giving few questions from these games in their final exams. Improvement in evaluating the parameters for GCG should be done constantly.
3. With the help of just one more observer performance of test group student in each game can be observed. This will help to judge interest area of test student, strong and weak points of the test student. Similarly, impartiality may be improved by introducing one more observer to subjectively evaluate GCG.
4. The scheme might be evolved all standards.

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Classes: 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup> (Science)

**Appendix 1**

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Marksheet For Science Games (Test Students)		
NAME OF THE STUDENT <u>xxxxxxxxxxxxxx</u>		
ROLL NO. 1		STD- 7th
GAME NO.	MARKS OBTAINED	MAX. MARKS
1	2	10
2	25	35
3	7	10
4	15	20
5	4	10
6	12	15
7	11	12
8	12	15
9	2	10

10	6	10
11	6	10
12	9	10
13	23	30
14	10	10
15	10	10
<b>TOTAL</b>	<b>154</b>	<b>217</b>
<b>Percentage</b>	<b>70.96 %</b>	

**Appendix 2:**

Name: XYZ		
<b>No.</b>	<b>Criteria (Out of)</b>	<b>Obt. Mks</b>
<b>1</b>	Choice of the Concept (4)	<b>4</b>
<b>2</b>	Process (12)	<b>10</b>
<b>3</b>	Simplicity (4)	<b>3</b>
<b>4</b>	Level (2)	<b>2</b>
<b>5</b>	Innovation (4)	<b>3</b>
<b>6</b>	Depth Of Knowledge (6)	<b>5</b>
<b>7</b>	Creativity (4)	<b>3</b>
<b>8</b>	Impact (4)	<b>4</b>
<b>9</b>	Team Work (4)	<b>3</b>
<b>10</b>	Evaluation Scheme (6)	<b>5</b>
	<b>Total (50)</b>	<b>42</b>