

LEARNING ACHIEVEMENT ASSESSMENT METHODS IN SCIENCE CURRICULUM

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Abstract

Science curriculum has an important role in teaching and learning at school. It influences knowledge and life skills formation of students. Using of assessment methods according to curriculum content as well as to different learning styles influence students' motivation to reach better achievements. Based on findings from questionnaires with science curriculum teachers it has been resulted that in general there was a non- uniform using of assessment methods according to curriculum content as well as to different students' learning styles. Assessment methods group based on oral answers of students was the most used. Meanwhile assessment methods group based on written answers of students was the less used. Test was the most used assessment method and composition the least used.

Keywords: *curriculum, assessment, science curriculum, assessment method*

1. Introduction

Science curriculum has an important role in school teaching and learning thrift, in knowledge and life skills formation of students. Learning achievement assessment methods have also an important role in students' achievement levels. Using of them in teaching in accordance with curriculum content as well as with learning styles of students would have an incentive and motivation influence on knowledge and skills formation of pupils.

2. Aim of study

The main aim of the paper is to research relationships between assessment methods and achievements of 15 years' students in science curriculum. The aim of the paper is to analyse frequencies of used assessment methods in teaching in science curriculum.

3. Research topics

- Frequencies of learning achievement assessment methods used in teaching in science curriculum.
- Report between different learning achievement assessment methods used in teaching in science curriculum.

4. Research questions

- What are the frequencies of learning achievement assessment methods used in teaching in science curriculum?

- What's the report between different learning achievement assessment methods used in teaching in science curriculum?

5. Scientific method

The paper was refers *interrupted time-series design research* that was served to research the relationships between assessment methods and pupils' achievements in science curriculum. The paper was refers also frequencies of assessment methods using in teaching in science curriculum analysis

6. Data analysis

To analyse frequencies of assessment methods using in teaching in science curriculum a structured questionnaire with teachers of science curriculum in four interrupted time series, so teachers of physics, chemistry, biology and geography inside PISA 2012 sample was used. The paper was referring the 1st interrupted time series. Frequencies of achievements assessment methods refer almost every time and always scales compared with using levels in teaching: (1) high level (81%- 100%); (2) relatively high level (61%- 80%); (3) over medium level (51%- 60%); (4) under medium level (41- 50%); (5) relatively low level (21- 40%); (6) low level (0- 20%) if they were used in such percentage in teaching.

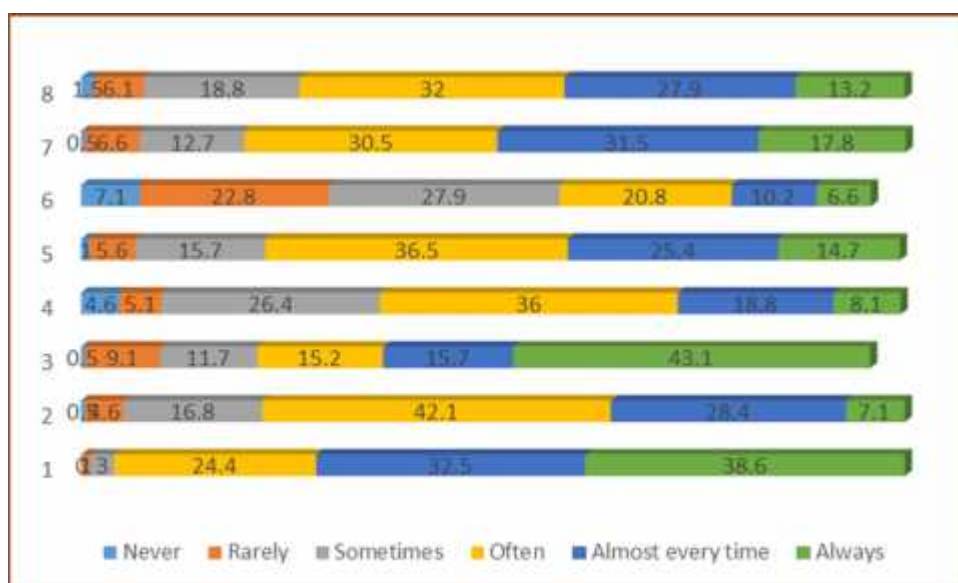
7. Findings

7.1 Assessment methods based on pupils' oral answers

Findings presented in this paper are based on generated data from structured questionnaire with science curriculum teachers in the 1st interrupted time series. In the 1st interrupted time series there were 196 (n = 196) science curriculum teachers (n = 196) from a population of 294 science curriculum teachers (N = 294). Data generated from structured questionnaire with science curriculum teachers in the 1st interrupted time series in table and graph form are as follows.

Table 1: Frequencies of assessment methods based on students' oral answers.

Frequency scale	Oral answer	Report	Project	Comment	Analyse a case	Paper presentation	Oral examination	Debate
	Frequencies in %							
Never	0	0.5	0.5	4.6	1.0	7.1	0.5	1.5
Rarely	1.0	4.6	9.1	5.1	5.6	22.8	6.6	6.1
Sometimes	3.0	16.8	11.7	26.4	15.7	27.9	12.7	18.8
Often	24.4	42.1	15.2	36.0	36.5	20.8	30.5	32.0
Almost every time	32.5	28.4	15.7	18.8	25.4	10.2	31.5	27.9
Always	38.6	7.1	43.1	8.1	14.7	6.6	17.8	13.2



Graph 1: Frequencies of assessment methods based on students' oral answers

According to data from assessment methods based on students' oral answers used frequencies it has been resulted that for *oral answer* 38.6 % of respondents reported that used always, 32.5 % of them almost every time, 24.4 % of them often, 3 % of them sometimes, 1% of them rarely, and never scale was not chosen from any respondent. It means that this assessment method refer almost every time and always scales, classical as well as modern assessment one is used in widespread scale in learning achievement assessment in science curriculum.

For *report* 7.1 % of respondents reported that used always, 28.4 % of them almost every time; meanwhile 42 % of them often, 16.8 % of them sometimes, 4.6% of them claim that they has been used it rarely, and 0.5% of them never. It means that this assessment method refer almost every time and always scales is used in less than ½ of teachers on learning achievement assessment in science curriculum.

43% of respondents claimed that used *project* always, 15.7 % of them almost every time, 15.2 % of them often, 11.7 % of them sometimes, 9.1% of them rarely, and 0.5% never. It means that in general this assessment method refer almost every time and always scales is used by the majority of teachers on learning achievement assessment in science curriculum.

Meanwhile for *comment* only 8.1% of respondents claimed that used always, 18.8 % of them almost every time, 36 % of them often, 26.4 % of them sometimes, 5.1% of them rarely, and 4.6% never. It is a clearly data that means for this assessment method refer almost every time and always scales is used by ¼ of teachers only on learning achievement assessment in science curriculum.

For *analyse a case* 14.7% of respondents claimed that used always, 25.4 % of them almost every time, 36.5 % of them often, 15.7 % of them sometimes, 5.6% of them rarely, and 16% never. It means that this assessment method refer almost every time and always scales is used by less than ½ of teachers on learning achievement assessment in science curriculum.

10.2 % of respondents claimed that *paper presentation* used always, 20.8 % of them almost every time, 20.8 % of them often, 27.9 % of them sometimes, 22.8% of them rarely, and 7.1% never. It is an indicator that this assessment method refers almost every time and always scales is used in medium level by teachers on learning achievement assessment in science curriculum.

For *oral examination* 17.8% of respondents claimed that used always, 31.5 % of them almost every time, 30.5 % of them often, 12.7 % of them sometimes, 6.6% of them rarely, and only

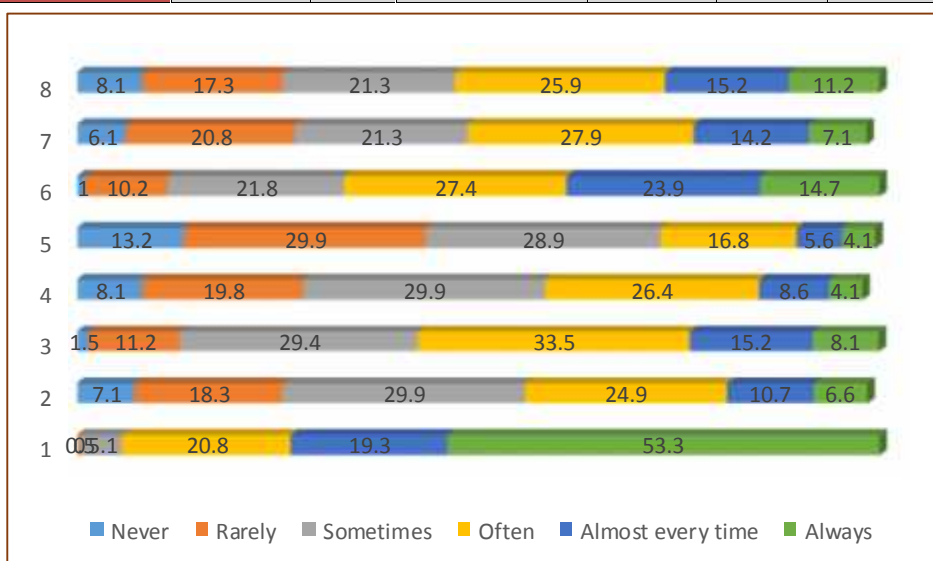
0.5% never. It means that this assessment method refer almost every time and always scales is used almost by ½ of teachers on learning achievement assessment in science curriculum. 13.2 % of respondents claimed that *debate* used always, 27.9 % of them almost every time, 32 % of them often, 18.8 % of them sometimes, 6.1% of them rarely, and 1.5% never. It means that this assessment method refer almost every time and always scales is used by less than ½ of teachers on learning achievement assessment in science curriculum.

Summarizing for achievement assessment methods based on pupils’ oral answers refer almost every time and always scales it has been resulted that; (1) in high level (81%- 100%) there has not been evidences; (2) in relatively high level (61%- 80%) it has been used *oral answer* (71.1%); (3) in over medium level (51- 60%) it has been used *project* (58.8%); (4) in under medium level (41- 50%) there has been used *oral examination* (49.3%), and *debate* (41.1 %); (5) in relatively low level (21- 40%) there has been used *comment* (26.9%), *report* (35.5%), *analyse a case* (40.1%); (6) in low level (0- 20%) it has been used *paper presentation* (16.8 %).

7.2 Achievement assessment methods based on students’ written answers

Table 2: Frequencies of assessment methods based on students’ written answers- first part

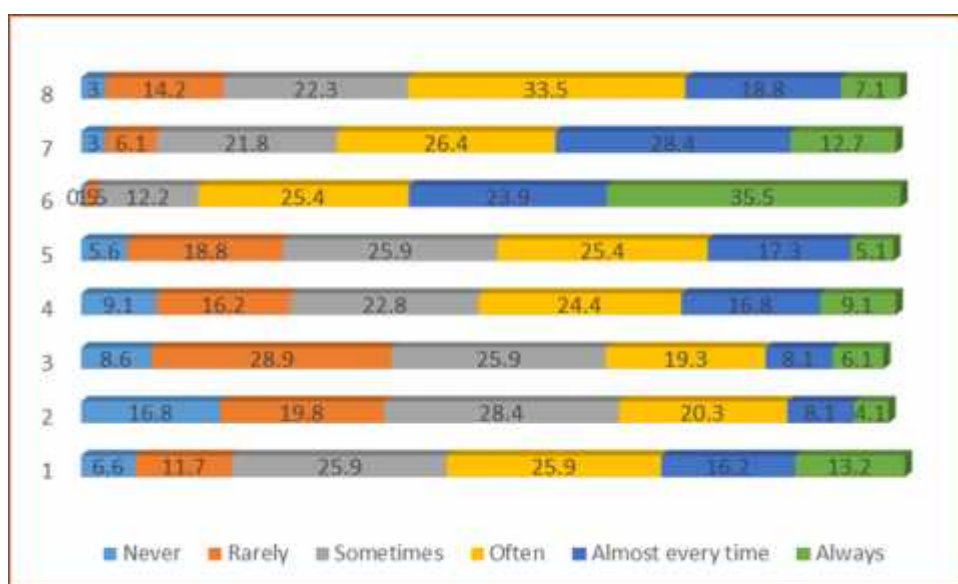
Frequency scale	Test	Essay	Summary composing	Evaluation	Composition	Work- based problem	Research	CD, DVD burning
	Frequencies in %							
Never	.0	7.1	1.5	8.1	13.2	1.0	6.1	8.1
Rarely	.5	18.3	11.2	19.8	29.9	10.2	20.8	17.3
Sometimes	5.1	29.9	29.4	29.9	28.9	21.8	21.3	21.3
Often	20.8	24.9	33.5	26.4	16.8	27.4	27.9	25.9
Almost every time	19.3	10.7	15.2	8.6	5.6	23.9	14.2	15.2
Always	53.3	6.6	8.1	4.1	4.1	14.7	7.1	11.2



Graph 2: Frequencies of assessment methods based on students' written answers- first part

Table 3: Frequencies of assessment methods based on students' written answers- second part

Frequency scale	Produce a poster	Prepare a manual	Annotated bibliography	Devise an encyclopaedia entry	Questionnaire compiling	Written examination	Question-answer composing	Hypothesis writing
	Frequencies in %							
Never	6.6	16.8	8.6	9.1	5.6	.5	3.0	3.0
Rarely	11.7	19.8	28.9	16.2	18.8	1.5	6.1	14.2
Sometimes	25.9	28.4	25.9	22.8	25.9	12.2	21.8	22.3
Often	25.9	20.3	19.3	24.4	25.4	25.4	26.4	33.5
Almost every time	16.2	8.1	8.1	16.8	17.3	23.9	28.4	18.8
Always	13.2	4.1	6.1	9.1	5.1	35.5	12.7	7.1



Graph 3: Frequencies of assessment methods based on students' written answers- second part

According to data from assessment methods based on students' written answers used frequencies it has been resulted that for *test* 53.3 % of respondents report that used always, 19.3 % of them almost every time, 20.3 % of them often, 5.1 % of them sometimes, only 0.5 % of them rarely, and never scale was not chosen from any respondent. It means that this assessment method refers almost every time and always scales is used in widespread scale in learning achievement assessment in science curriculum.

Different data came out for *essay*. So only 6.6 % of respondents reported that used always, 10.7 % of them almost every time, 24.9 % of them often, 29.9 % of them sometimes, 18.3 % of them rarely, and 7.1% never. It means that this assessment method refers almost every time and always scales is used relatively in low scale in learning achievement assessment in science curriculum.

For *summary composing* 8.1 % of respondents reported that used always, 15.2 % of them almost every time, 33.5 % of them often, 29.4 % of them sometimes, 11.2 % of them rarely, and 1.5% never. It means that this assessment method refers almost every time and always scales is used relatively in low figures in learning achievement assessment in science curriculum.

4.1 % of respondents reported that used *evaluation* always, 8.6 % of them almost every time, 26.4 % of them often, 29.9 % of them sometimes, 19.8 % of them rarely, and 8.1% never. It means that this assessment method refers almost every time and always scales is used relatively in low figures in learning achievement assessment in science curriculum.

Respondents claimed that used *composition* as follows: 4.1 % of them report they apply *evaluation* assessment method always, 5.6 % of them almost every time, 16.8 % of them often, 28.9 % of them sometimes, 29.9 % of them rarely, and 13.2% never. These reported data mean that this assessment method refers almost every time and always scales is used in very low figures in learning achievement assessment in science curriculum.

14.7 % of respondents claimed that used *work- based problem* always, 23.9 % of them almost every time, 27.4 % of them often, 21.8 % of them sometimes, 10.2 % of them rarely, and 1% never. It means that this assessment method refers almost every time and always scales is used by less than ½ of teachers in learning achievement assessment in science curriculum.

For *research* 7.1 % of respondents reported that used always, 14.2 % of them almost every time, 27.9 % of them often, 21.3 % of them sometimes, 20.8 % of them rarely, and 6.1% never. These data means that this assessment method refer almost every time and always scales is used in low figures in learning achievement assessment in science curriculum.

11.2 % of respondents claimed that used *CD, DVD burning* always, 15.2 % of them almost every time, 25.9 % of them often, 21.3 % of them sometimes, 17.3 % of them rarely, and 8.1% never. It means that this assessment method refer almost every time and always scales is used relatively in low level by teachers in learning achievement assessment in science curriculum.

Regarding to *produce a poster* 13.2 % of respondents claimed that used *CD, DVD burning* assessment method always, 16.2 % of them almost every time, 25.9 % of them often, 25.9 % of them sometimes, 11.7 % of them rarely, and 6.6% never. It means that this assessment method refers almost every time and always scales is used relatively in low level by teachers in learning achievement assessment in science curriculum.

4.1 % of respondents claimed that used *prepare a manual* always, 8.1 % of them almost every time, 20.3 % of them often, 28.4 % of them sometimes, 19.8 % of them rarely, and 16.8% never. It means that this assessment method refers almost every time and always scales is used in low level in learning achievement assessment in science curriculum.

For *annotated bibliography* 6.1 % of respondents reported that used always, 8.1 % of them almost every time, 19.3 % of them often, 25.9 % of them sometimes, 28.9 % of them rarely, and 8.6% never. These data means that this assessment method refers almost every time and always scales is used in low figures in learning achievement assessment in science curriculum.

9.1 % of respondents claimed that used *devise an encyclopedia entry* always, 16.8 % of them almost every time, 24.4 % of them often, 22.8 % of them sometimes, 16.2 % of them rarely, and 9.1% never. It means that this assessment method refers almost every time and always scales is used relatively in low level in learning achievement assessment in science curriculum.

Regarding to *questionnaire composing* 5.1 % of respondents claimed that used always, 17.3 % of them almost every time, 25.4 % of them often, 25.9 % of them sometimes, 18.8 % of them rarely, and 5.6% never. It means that this assessment method refers almost every time

and always scales is used relatively in low level in learning achievement assessment in science curriculum.

35.5 % of respondents claimed that used *written examination* assessment method always, 23.9 % of them almost every time, 25.4 % of them often, 12.2 % of them sometimes, 1.5 % of them rarely, and 0.5% never. It means that this assessment method refers almost every time and always scales is used by the majority of teachers in learning achievement assessment in science curriculum.

For *question- answer composing* 12.7 % of respondents reported that used always, 28.4 % of them almost every time, 26.4 % of them often, 21.8 % of them sometimes, 6.1 % of them rarely, and 3% never. These data means that this assessment method refers almost every time and always scales is used in less than ½ of teachers in learning achievement assessment in science curriculum.

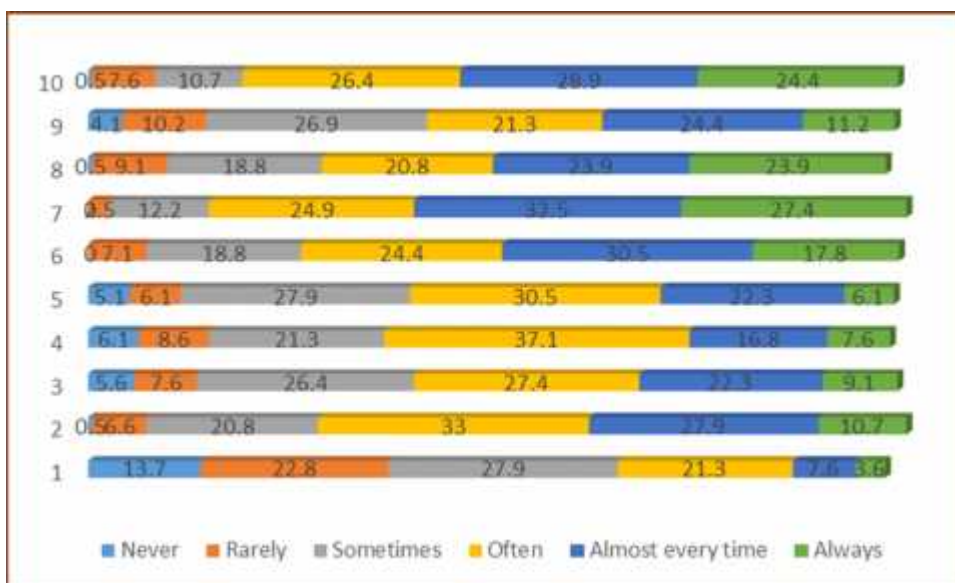
7.1 % of respondents claimed that used *hypothesis writing* always, 18.8 % of them almost every time, 35.5 % of them often, 23.3 % of them sometimes, 14.2 % of them rarely, and 3% never. It means that this assessment method refers almost every time and always scales is used relatively in low level in learning achievement assessment in science curriculum.

Summarizing for achievement assessment methods based on pupils' written answers refer almost every time and always scales it has been resulted that; (1) in high level (81%- 100%) there has not been evidences; (2) in relatively high level (61%- 80%) ti has been used *test* (72.6%); (3) in over medium level (51- 60%) it has been used *written examination* (59.4%); (4) in under medium level (41- 50%) it has been used *question- answer composing* (41.1 %); (5) in relatively low level (21- 40%) there has been used *summary composing, work- based problem, research, CD, DVD burning, produce a poster, devise an encyclopaedia entry, questionnaire composing, hypothesis writing* (23.3 %, 38.6 %, 21.3 %, 26.4 %, 29.4 %, 25.9 %, 22.4 %, 25.9%); (6) in low level (0- 20%) there has been used *essay, evaluation, composition, prepare a manual, annotated bibliography* (17.3%, 12.7 %, 9.7%, 12.2 %, 14.2 %).

7.3 Achievement assessment methods based on teacher survey

Table 4: Frequencies of assessment methods based on teacher survey

Frequency scale	Anecdotic evidence	Control list	Participating bulletin	Discussing bulletin	Evaluation scale	Portfolio	Group work	Presentation	Demonstration	Laboratory work
	Frequencies in %									
Never	13.7	0.5	5.6	6.1	5.1	0	0	0.5	4.1	0.5
Rarely	22.8	6.6	7.6	8.6	6.1	7.1	2.5	9.1	10.2	7.6
Sometimes	27.9	20.8	26.4	21.3	27.9	18.8	12.2	18.8	26.9	10.7
Often	21.3	33.0	27.4	37.1	30.5	24.4	24.9	20.8	21.3	26.4
Almost every time	7.6	27.9	22.3	16.8	22.3	30.5	32.5	23.9	24.4	28.9
Always	3.6	10.7	9.1	7.6	6.1	17.8	27.4	23.9	11.2	24.4



Graph 4: Frequencies of assessment methods based on teacher survey

According to data from assessment methods based on teacher survey used frequencies it has been resulted that for *anecdotic evidence* 3.6 % of respondents reported that used always, 7.6 % of them almost every time, 21.3 % of them often, 27.9 % of them sometimes, 22.8 % of them rarely, and 13.7% never. It means that this assessment method refers almost every time and always scales is used relatively in low level in learning achievement assessment in science curriculum.

10.7 % of respondents claimed that used *control list* always, 27.9 % of them almost every time, 33 % of them often, 20.8 % of them sometimes, 6.6 % of them rarely, and 0.5 % never. It means that this assessment method refers almost every time and always scales is used by less than ½ of teachers in learning achievement assessment in science curriculum.

For *participation bulletin* 9.1 % of respondents reported that used always, 22.3 % of them almost every time, 27.4 % of them often, 26.4 % of them sometimes, 7.6 % of them rarely, and 5.6 % never. These data means that this assessment method refers almost every time and always scales is used in low level in learning achievement assessment in science curriculum.

7.6 % of respondents claimed that used *discussion bulletin* always, 16.8 % of them almost every time, 37.1 % of them often, 21.3 % of them sometimes, 8.6 % of them rarely, and 6.1 % never. It means that this assessment method refers almost every time and always scales is used by around ¼ of teachers in learning achievement assessment in science curriculum.

For *evaluation scale* 6.1 % of respondents reported that used always, 22.3 % of them almost every time, 30.5 % of them often, 27.9 % of them sometimes, 6.1 % of them rarely, and 5.1 % never. These data means that this assessment method refers almost every time and always scales is used in low level in learning achievement assessment in science curriculum.

Portfolio according to 17.8 % of respondent's reported that used always, according to 30.5 % of them almost every time, according to 24.4 % of them often, according to 18.8 % of them sometimes, according to 7.1 % of them rarely, and according to 0 % never. These data means that this assessment method refers almost every time and always scales is used by ½ of teachers in learning achievement assessment in science curriculum.

27.4 % of respondents claimed that used *group work* always, 32.5 % of them almost every time, 24.9 % of them often, 12.2 % of them sometimes, 2.5 % of them rarely, and 0 % never. It means that this assessment method refers almost every time and always scales is used by the majority of teachers in learning achievement assessment in science curriculum.

23.9 % of respondents claimed that used *presentation* always, 23.9 % of them almost every time, 20.8 % of them often, 18.8 % of them sometimes, 9.1 % of them rarely, and 0 % never.

It means that this assessment method refers almost every time and always scales is used by $\frac{1}{2}$ of teachers in learning achievement assessment in science curriculum.

For *demonstration* 11.2 % of respondents reported that used always, 24.4 % of them almost every time, 21.3 % of them often, 26.9 % of them sometimes, 10.2 % of them rarely, and 4.1 % never. These data means that this assessment method refers almost every time and always scales is used less than medium level in learning achievement assessment in science curriculum.

24.4 % of respondents claimed that used *laboratory work* always, 28.9 % of them almost every time, 26.4 % of them often, 10.7 % of them sometimes, 7.6 % of them rarely, and 0.5 % never. It means that this assessment method refers almost every time and always scales is used by more than $\frac{1}{2}$ of teachers in learning achievement assessment in science curriculum.

Summarizing for achievement assessment methods based on teacher survey refer almost every time and always scales it has been resulted that; (1) in high level (81%- 100%) there has not been evidences; (2) in relatively high level (61%- 80%) there has not been evidences; (3) in over medium level (51- 60%) there has been used *group work* (59.9%), *laboratory work* (53.3%); (4) in under medium level (41- 50%) there has been used *portfolio* (48.3%), *presentation* (47.8%); (5) in relatively low level (21- 40%) there has been used *control list*, *participation bulletin*, *discussion bulletin*, *evaluation scale*, *demonstration*, (38.6%, 31.4 %, 24.4 %, 28.4 %, 35.6%); (6) in low level (0- 20%) it has been used *anecdotic evidence* (11.2 %).

8. Comparison of frequencies of achievement assessment methods in science curriculum

Comparing frequencies according to methods group of assessment based on students' oral answers, on students' written answers, and on teacher survey, it has been resulted that higher figure belong to method groups of assessment based on students' oral answers (39.25 %); followed by method groups of assessment based on teacher survey (32%), and 28.75 % of frequencies belong to method groups of assessment based on students' written answers.

Comparing frequencies in total that include three methods group of achievement assessment it has been resulted that highest frequency assessment method was test (74%), followed by oral answer (70%), and written examination as well as group work (60%).

From the other side comparing frequencies in total it has been resulted that lowest frequency assessment method was composition (10%), followed by anecdotic evidence (11%), and prepare a manual (12%).

9. Conclusions

- Based on findings from questionnaires with science curriculum teachers it has been resulted that in general there was a non- uniform using of assessment methods according to curriculum content as well as to different students' learning styles.
- Assessment methods group based on oral answers of students was the most used, followed by assessment methods group based on teacher survey. Meanwhile assessment methods group based on written answers of students was the less used.
- Test was the most used assessment method followed by oral examination, written examination, and group work.

- Composition was the least used assessment method followed by anecdotic evidence and prepare a manual.

10. Recommendations

- Science curriculum teachers should apply u uniform achievement assessment methods according to curriculum content as well as to different styles of student learning in teaching process.
- Using of different achievement assessment methods should be adapted with science curriculum specific content of knowledge, skills, attitudes and values.
- Science curriculum teachers should apply new achievement assessment methods according to curriculum content as well as to different styles of student learning in science curriculum teaching process.
- Educational institutions should compile and apply professional development programmes focused on achievement assessment methods.

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