



Virtual Instrumentation Software – Comparative study (II)

Content:

- A. Introduction
- B. Criteria
- C. Results
- D. Observations and Conclusions

A. Introduction

As continuing the evaluation / comparison of the software chosen for developing the process of training inside the Training Modules, the following research took in consideration the initial software packages selected for virtual experiments designing and developing (*Cabri Geometry II, LabVIEW, Crocodile Clips*) and also the new software used in the second year of the project - *GeoGebra*. In this sense, the comparative studies deal with four, instead of three, different types of software used for developing virtual experiments. Even that the Project WorkPlan has foreseen the realisation of a comparative study on the previous mentioned VI environments just in the first year, the partnership agreed to continue the work on this important aspect also in the second year of the project, having in view the same two important points of view: *pedagogical* and *technical*.

In order to conduct the comparative studies, the same questionnaire designed by the Patras team has been conducted among the local coordinators and the course tutors. The Questionnaire proposed 10 criteria: usability; collaboration; active learning; expression of students' knowledge; holistic approaches in learning; interesting activities; promoting pupils' reflection; providing appropriate feedback; designing various activities; concept/content teacher. The interviewee was to choose one of the five answers: *Not good, Weak, Middle, Good, Very good* for all the criteria. The answers were collected and the Bielsko-Biala team together with the Targoviste team elaborated this evaluation material. 23 course tutors from the participating institutions were asked to fill in a questionnaire.



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B. Criteria

The evaluation of the software was done with the respect to the following issues:

1. Usability

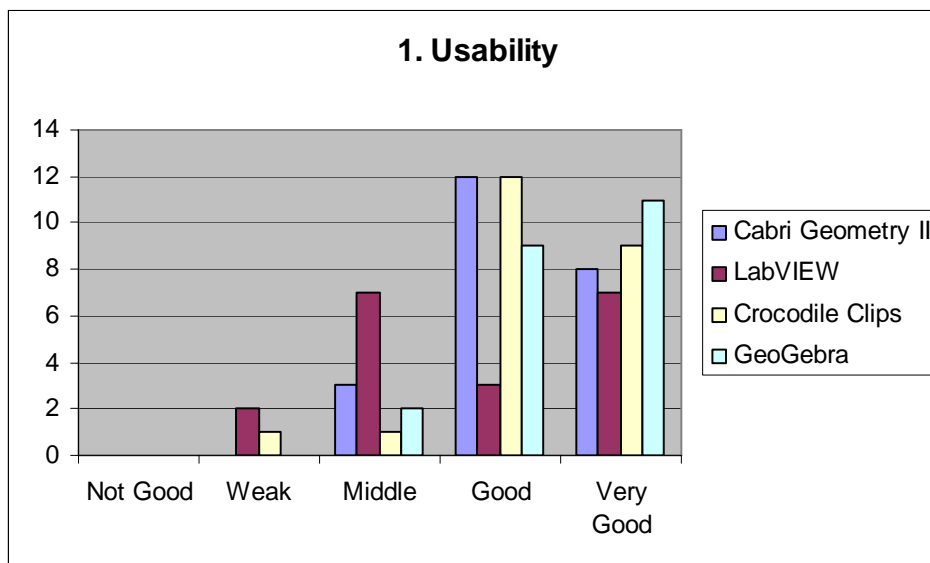


Figure 1. Usability criterion

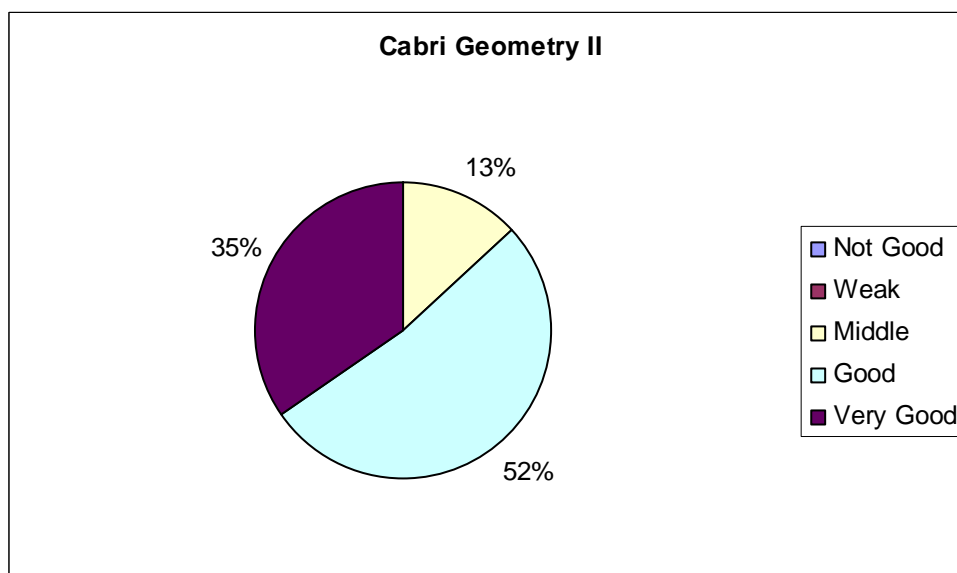


Figure 2. Cabri Geometri II Evaluation – Usability criterion



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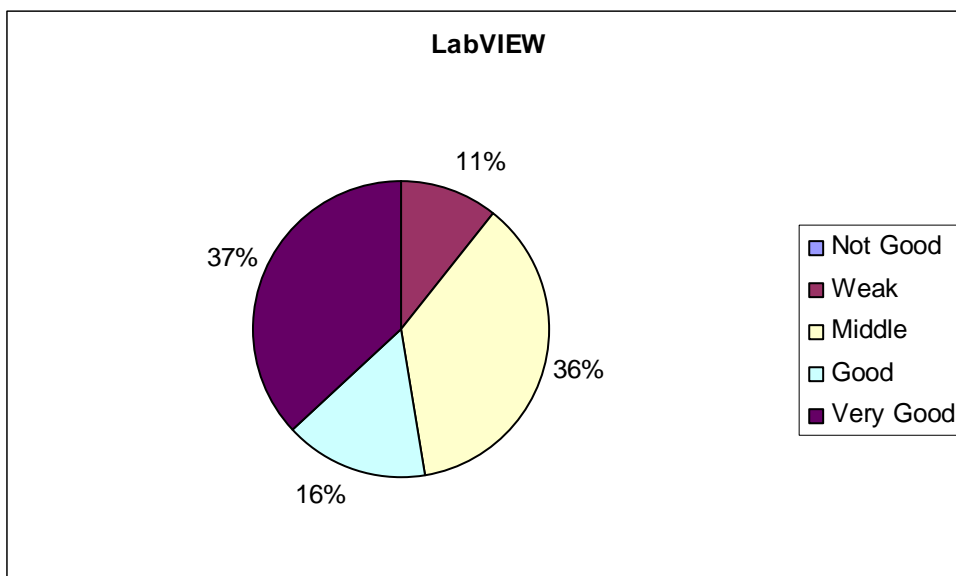


Figure 3. *LabView* Evaluation – *Usability* criterion

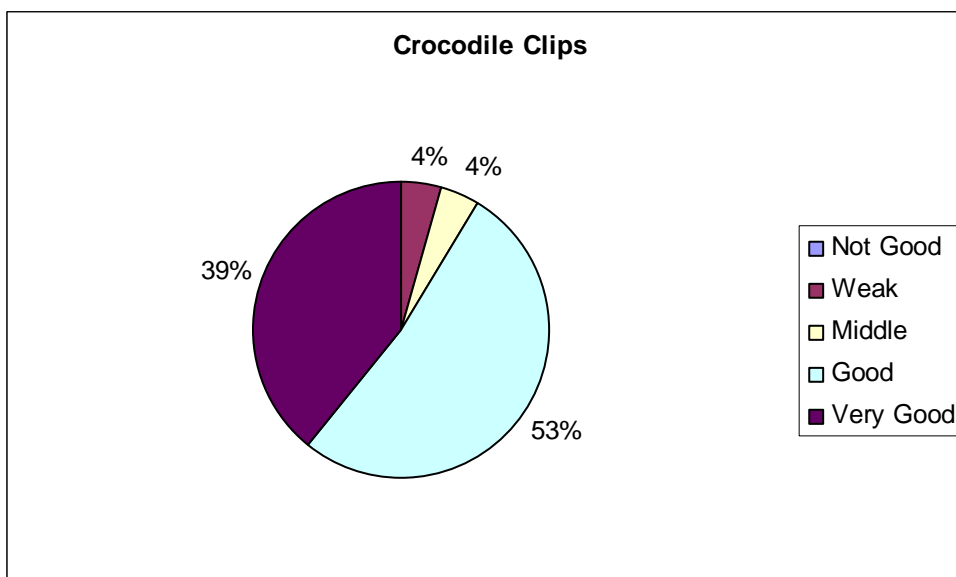


Figure 4. *Crocodile Clips* Evaluation – *Usability* criterion



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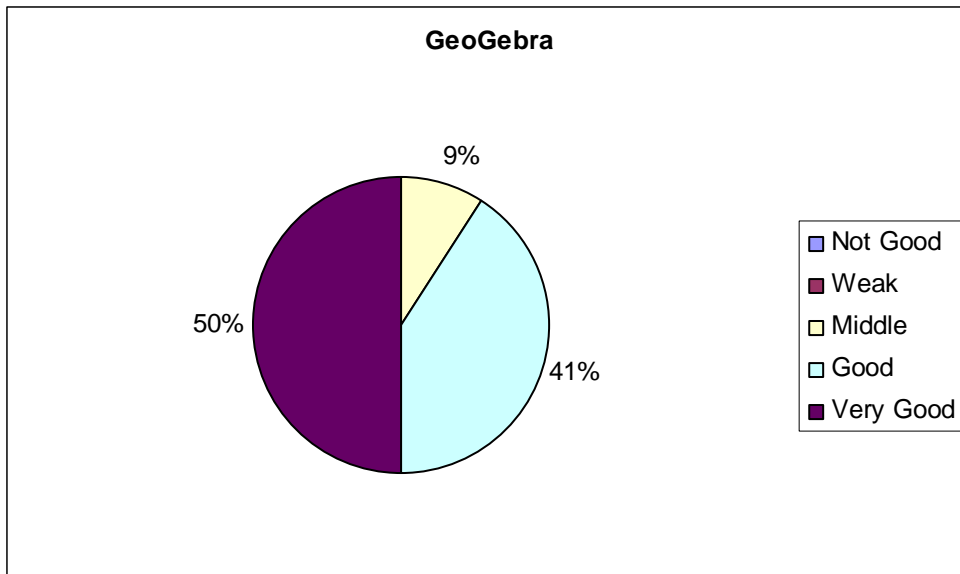


Figure 5. *GeoGebra* Evaluation – *Usability* criterion

2. Collaboration

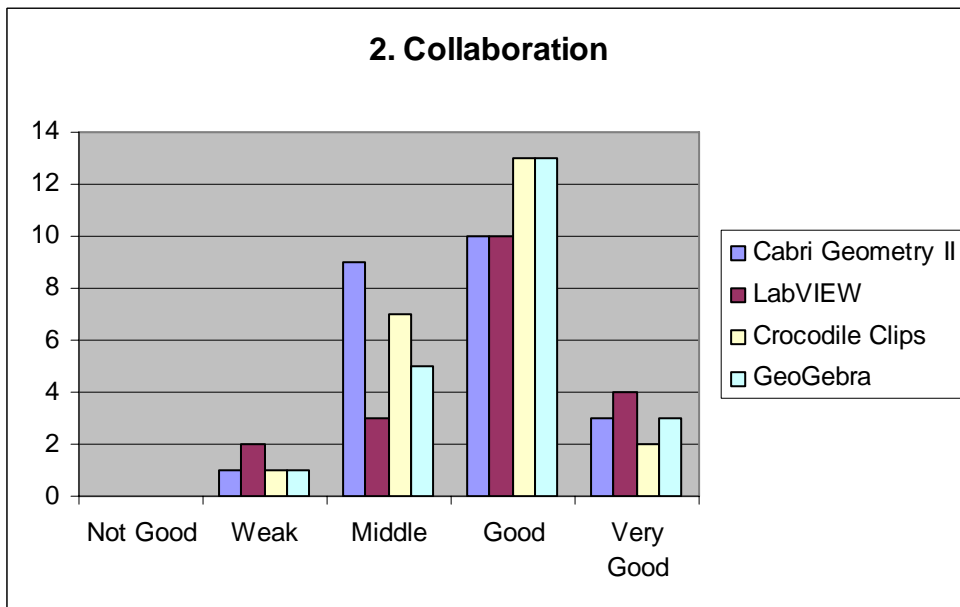


Figure 6. *Collaboration* criterion



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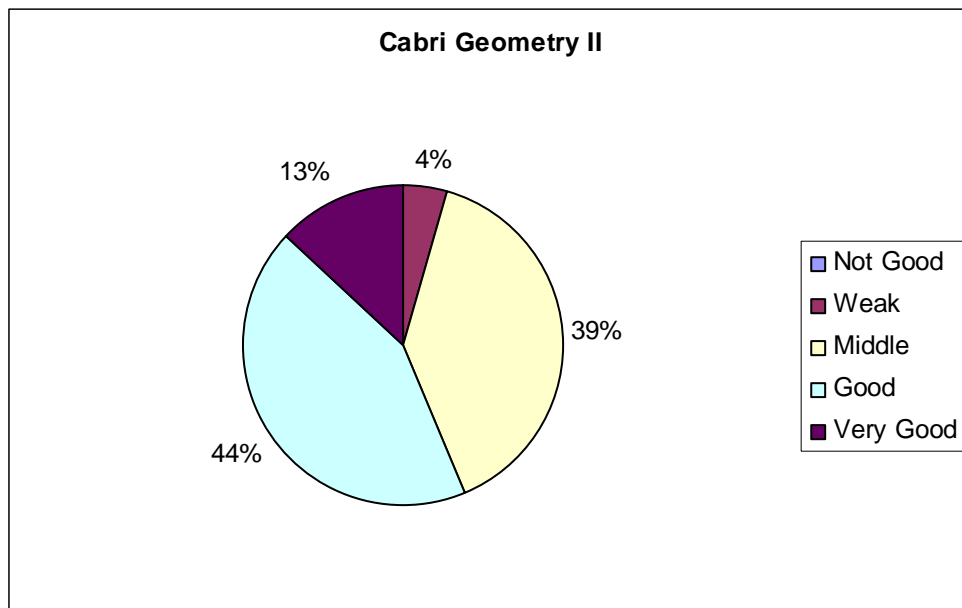


Figure 7. *Cabri Geometry II* Evaluation – *Collaboration* criterion

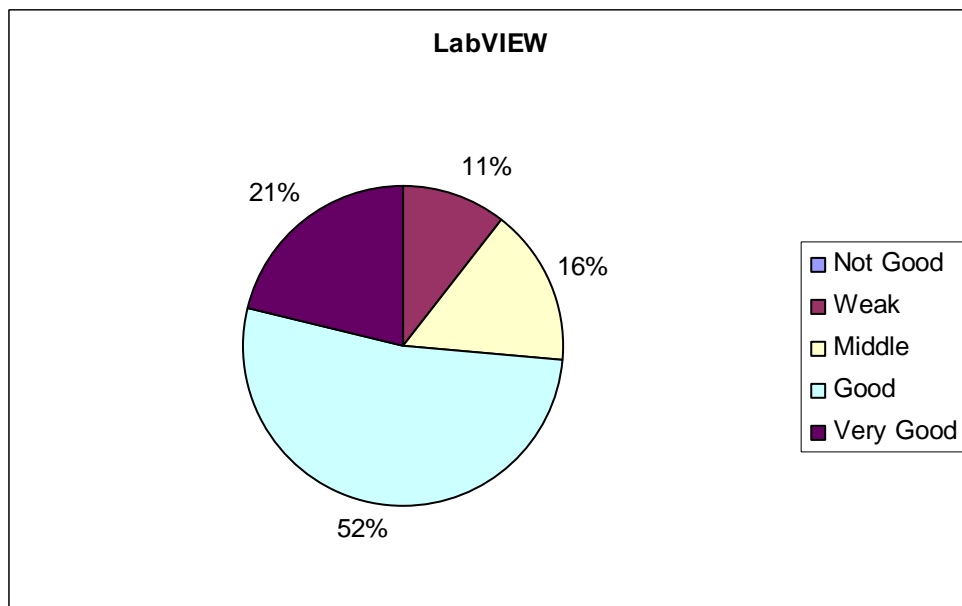


Figure 8. *LabView* Evaluation – *Collaboration* criterion



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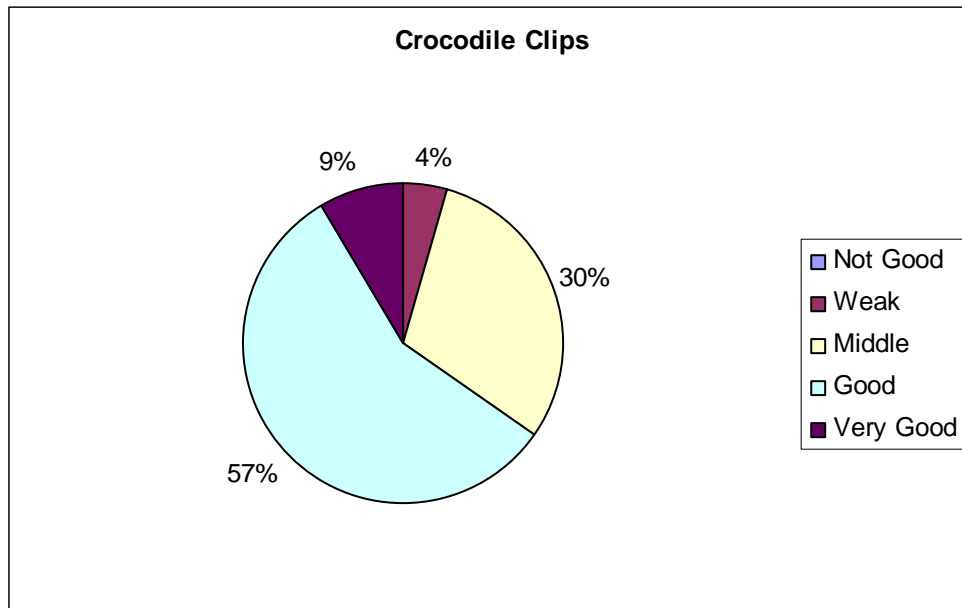


Figure 9. *Crocodile Clips* Evaluation – *Collaboration* criterion

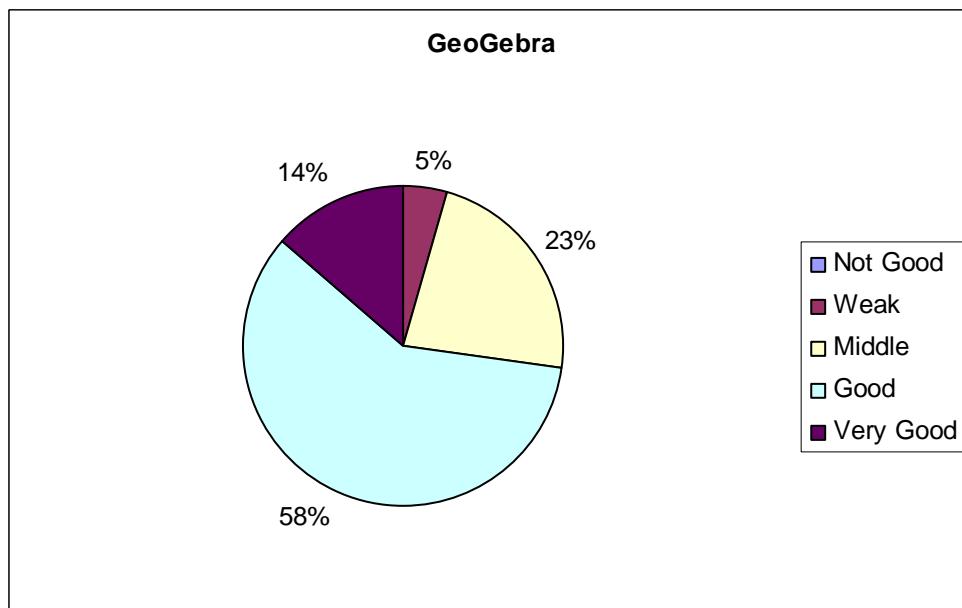


Figure 10. *GeoGebra* Evaluation – *Collaboration* criterion



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3. Active learning

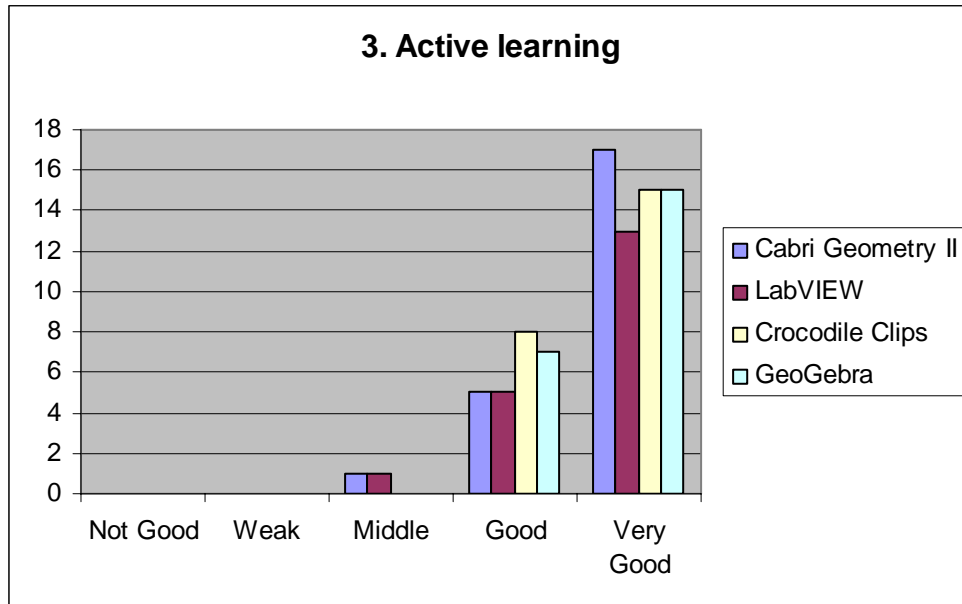


Figure 11. *Active learning* criterion

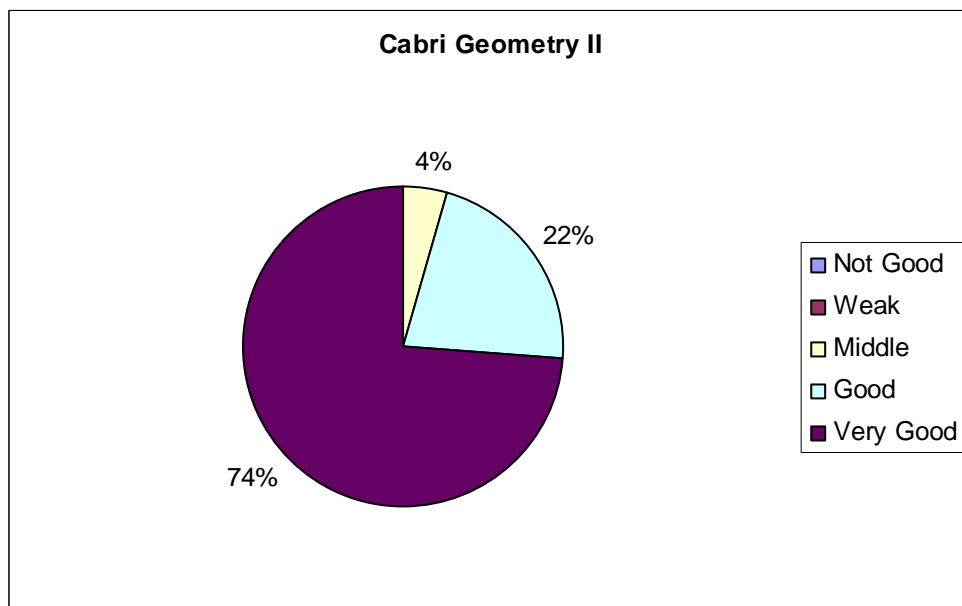


Figure 12. *Cabri Geometry* Evaluation - *Active learning* criterion



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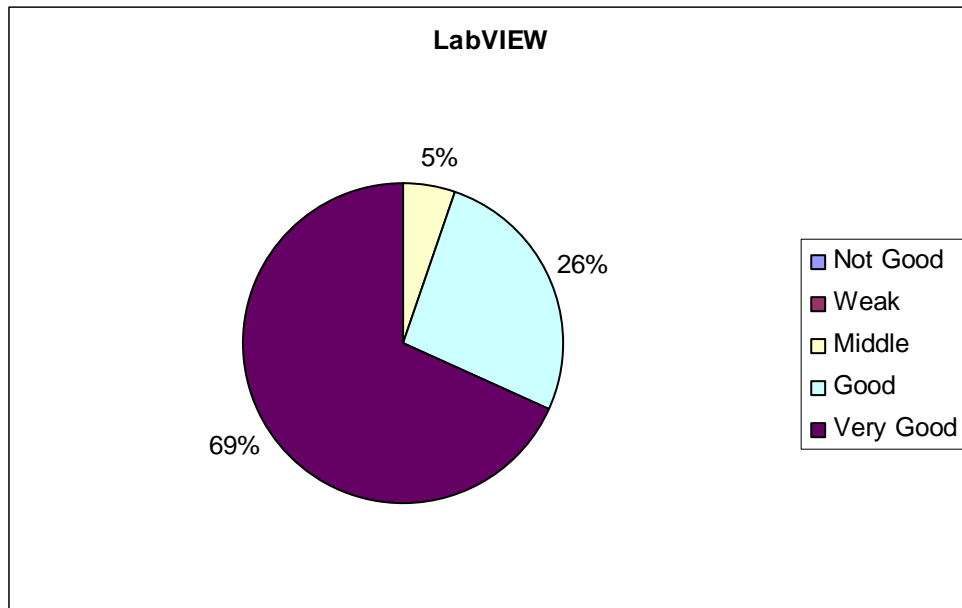


Figure 13. *LabView* Evaluation - *Active learning* criterion

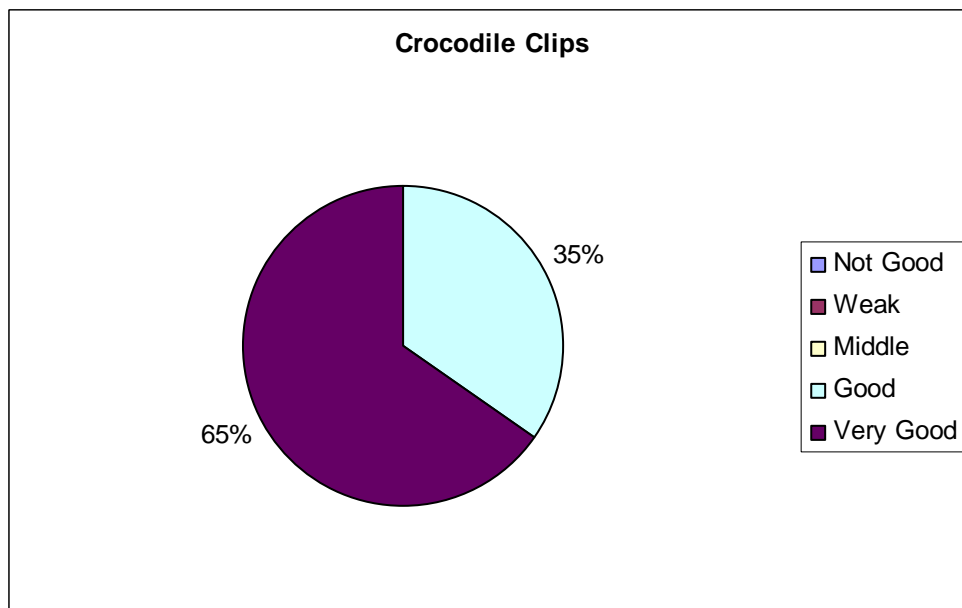


Figure 14. *Crocodile Clips* Evaluation - *Active learning* criterion



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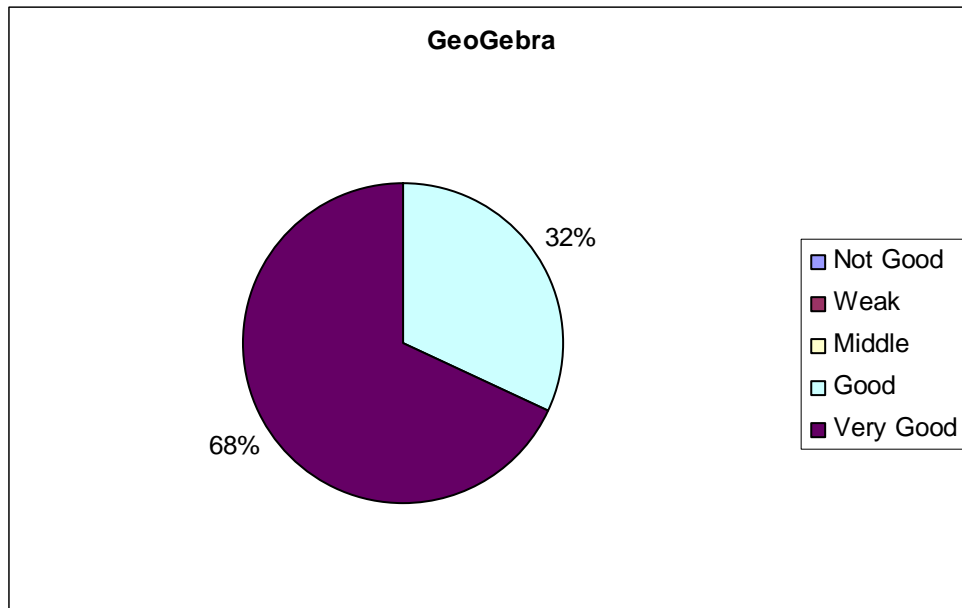


Figure 15. *GeoGebra* Evaluation - *Active learning* criterion

4. Expression of students' knowledge

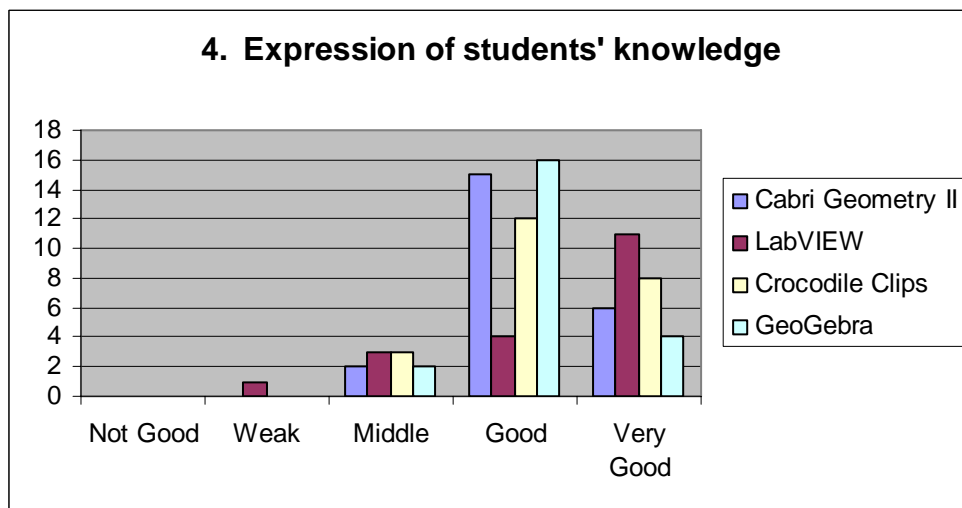


Figure 16. *Expression of students' knowledge* criterion



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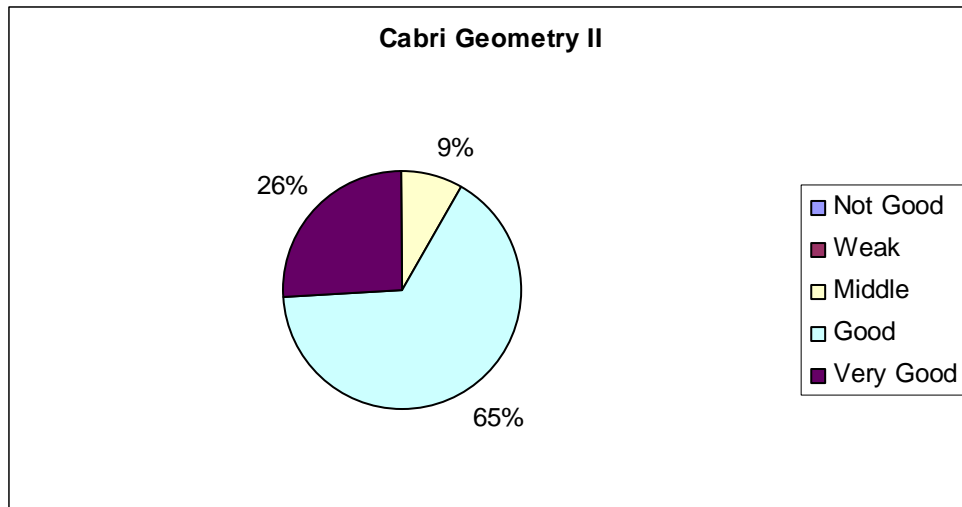


Figure 17. *Cabri Geometry* Evaluation - *Expression of students' knowledge criterion*

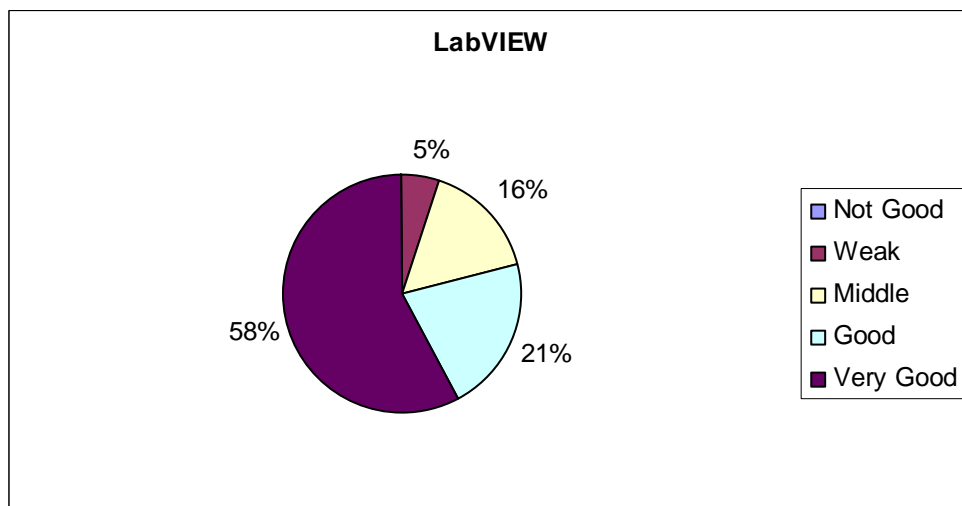


Figure 18. *LabView* Evaluation - *Expression of students' knowledge criterion*



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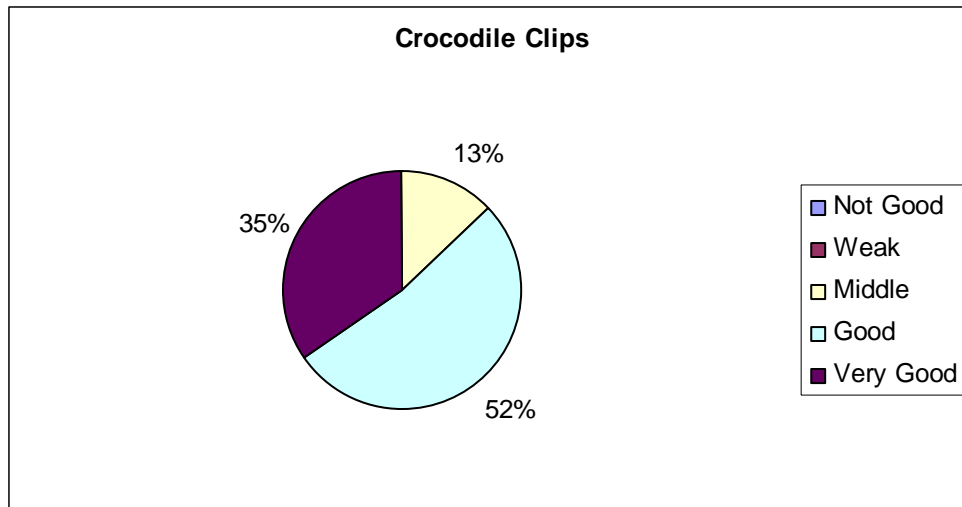


Figure 19. *Crocodile Clips* Evaluation - *Expression of students' knowledge* criterion

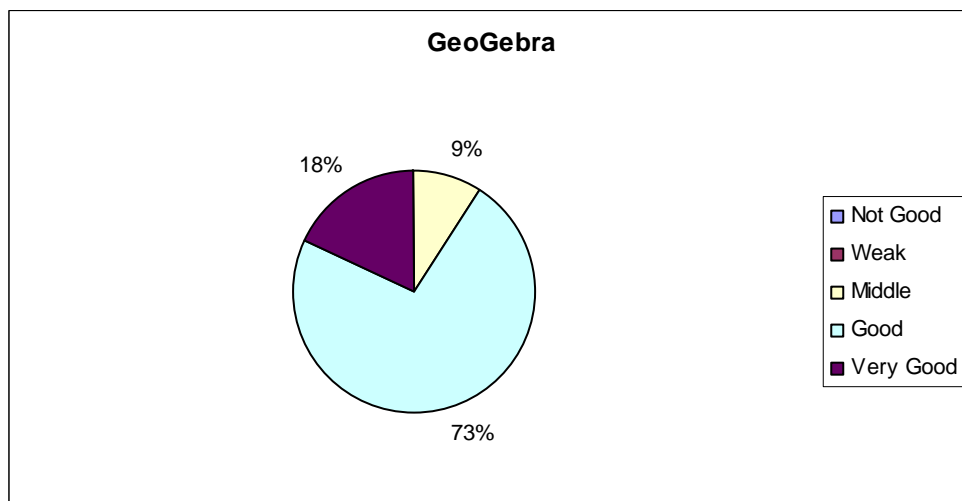


Figure 20. *GeoGebra* Evaluation - *Expression of students' knowledge* criterion



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5. Holistic approaches in learning

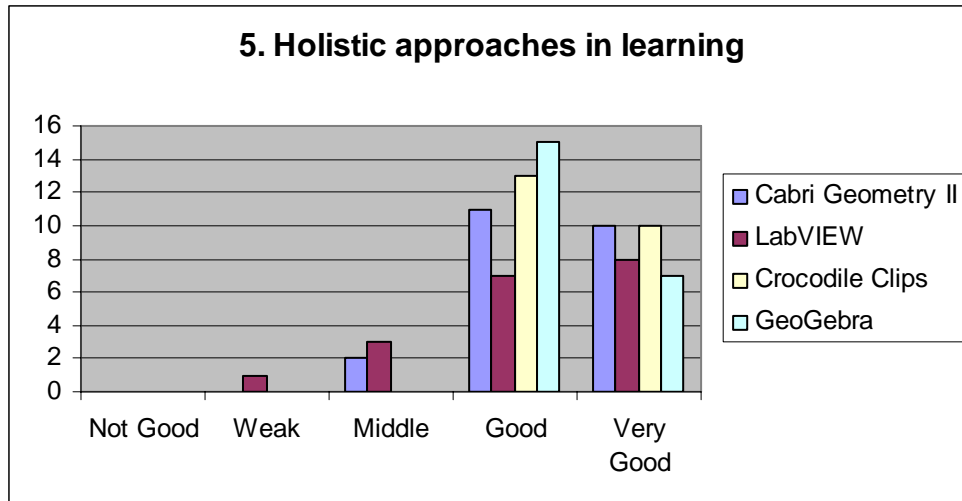


Figure 21. *Holistic approaches in learning* criterion

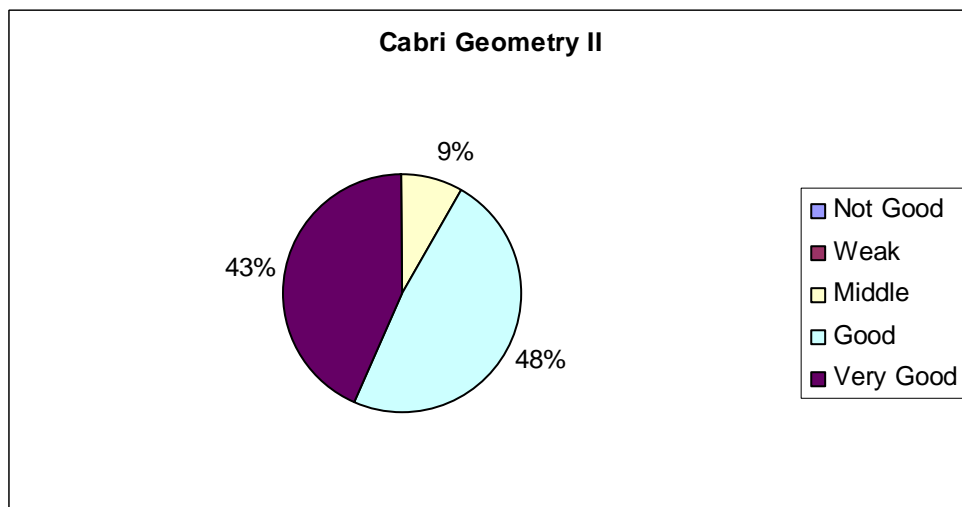


Figure 22. *Cabri Geometry* Evaluation - *Holistic approaches in learning* criterion



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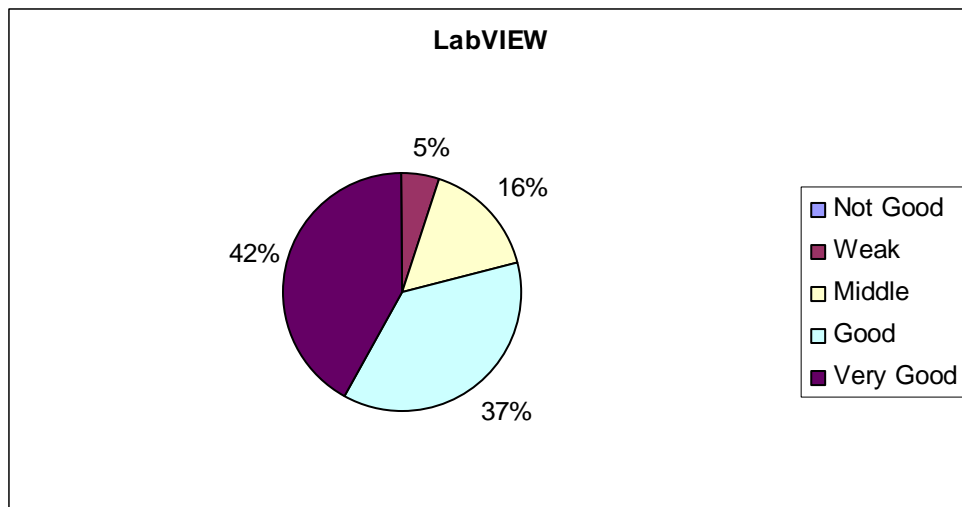


Figure 23. *LabView* Evaluation - *Holistic approaches in learning* criterion

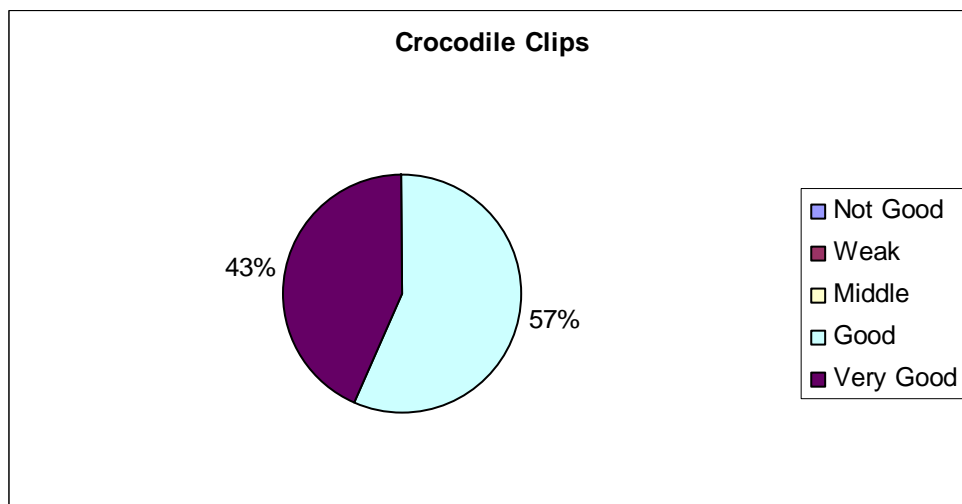


Figure 24. *Crocodile Clips* Evaluation - *Holistic approaches in learning* criterion



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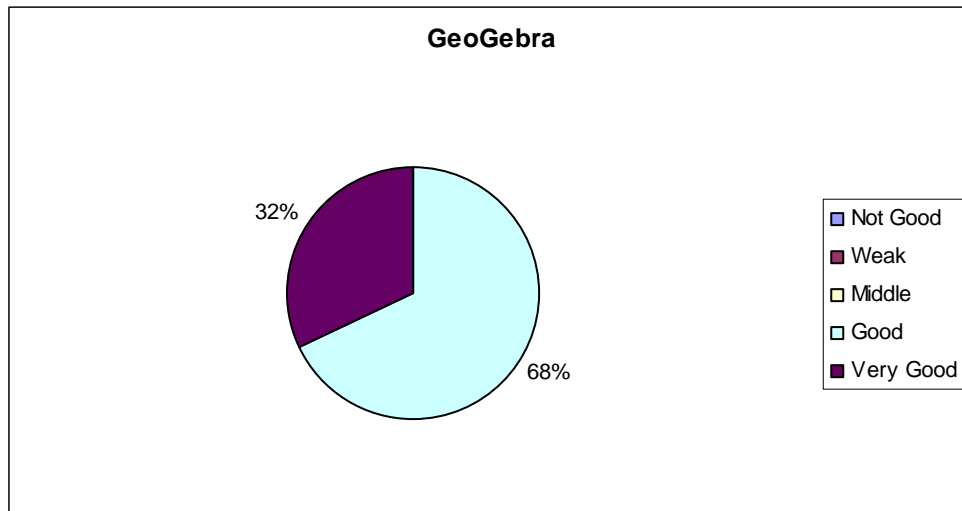


Figure 25. *GeoGebra* Evaluation - *Holistic approaches in learning* criterion

6. Interesting activities

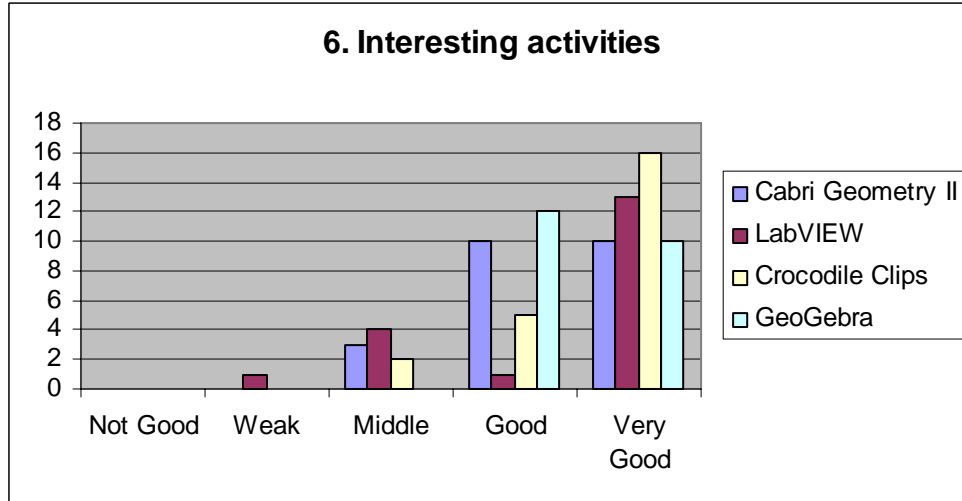


Figure 26. *Interesting activities* criterion



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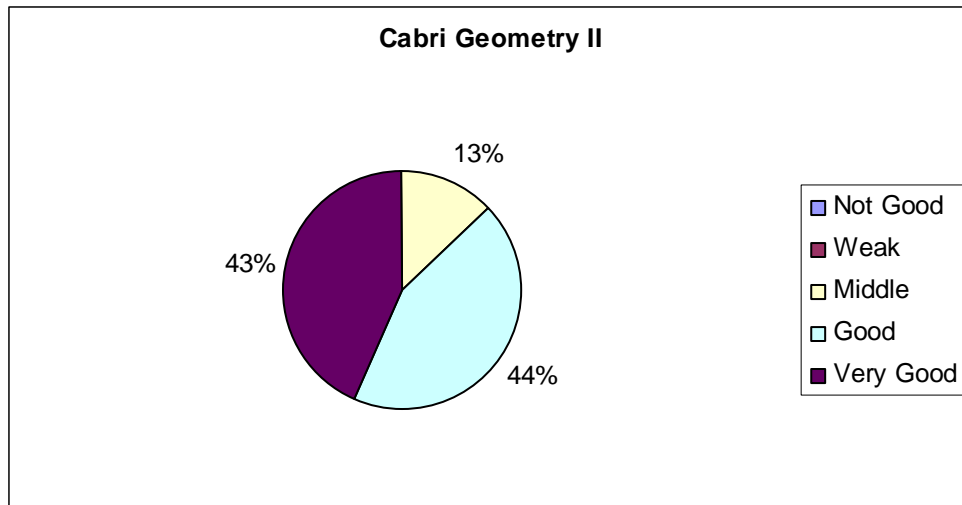


Figure 27. *Cabri Geometry* Evaluation – *Interesting activities* criterion

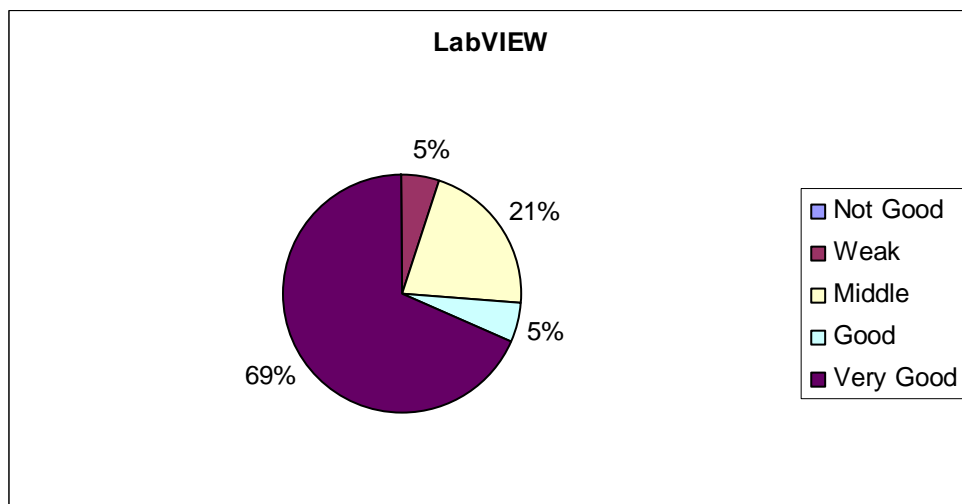


Figure 28. *LabView* Evaluation – *Interesting activities* criterion



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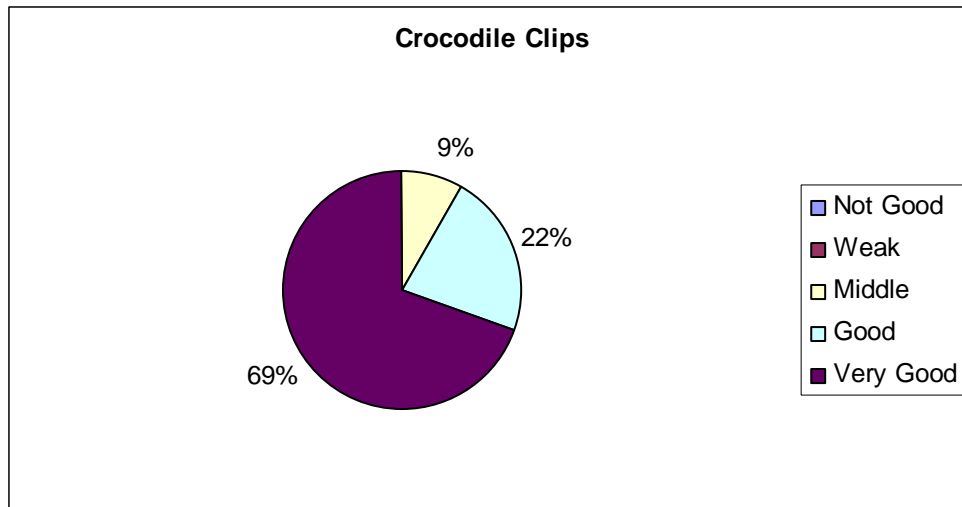


Figure 29. *Crocodile Clips* Evaluation – *Interesting activities* criterion

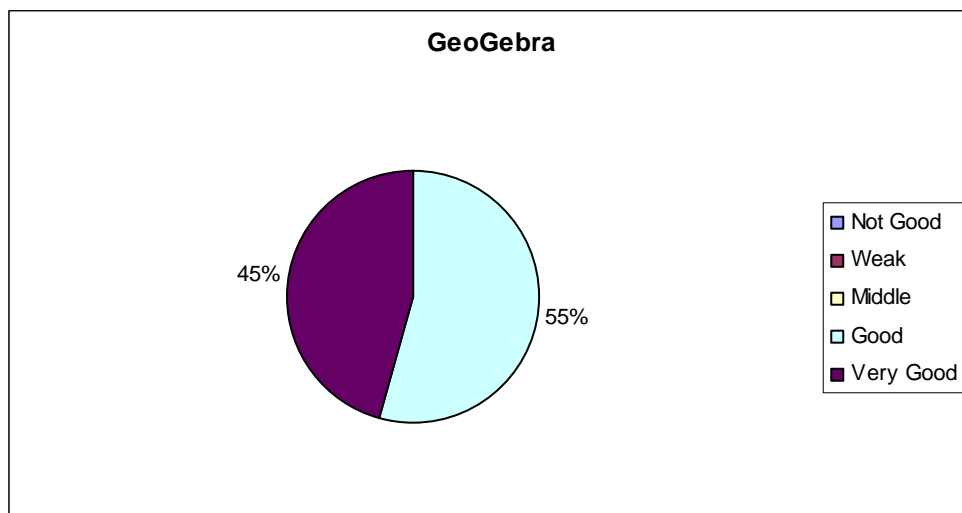


Figure 30. *GeoGebra* Evaluation – *Interesting activities* criterion



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7. Promoting pupils' reflection

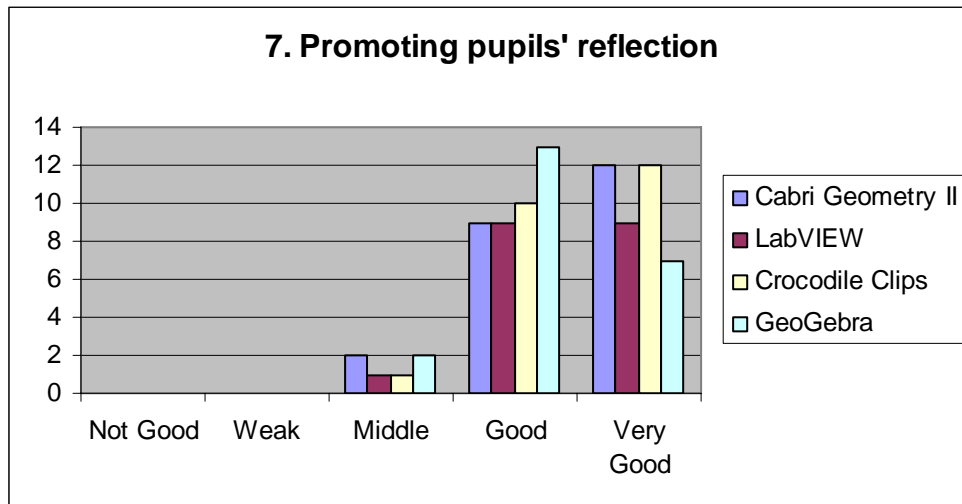


Figure 31. *Promoting pupils' reflection* criterion

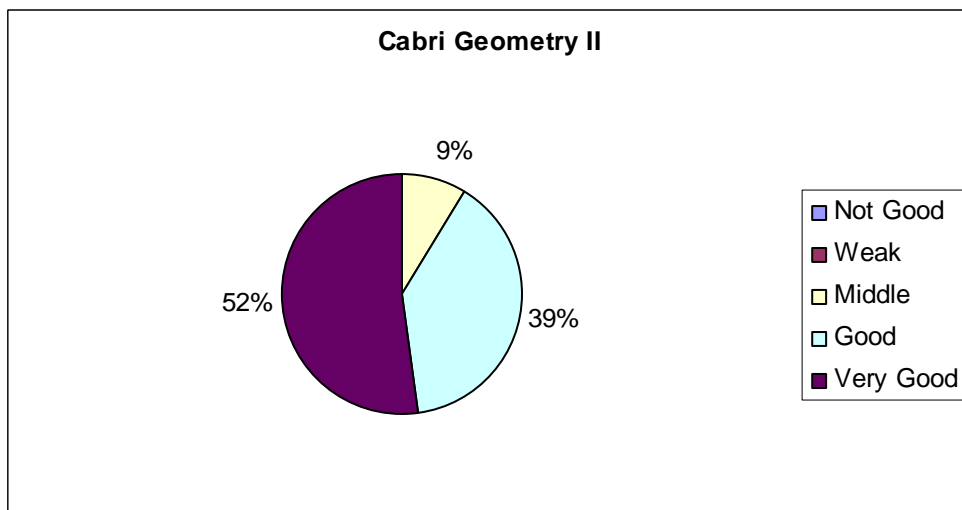


Figure 32. *Cabri Geometry* Evaluation - *Promoting pupils' reflection* criterion



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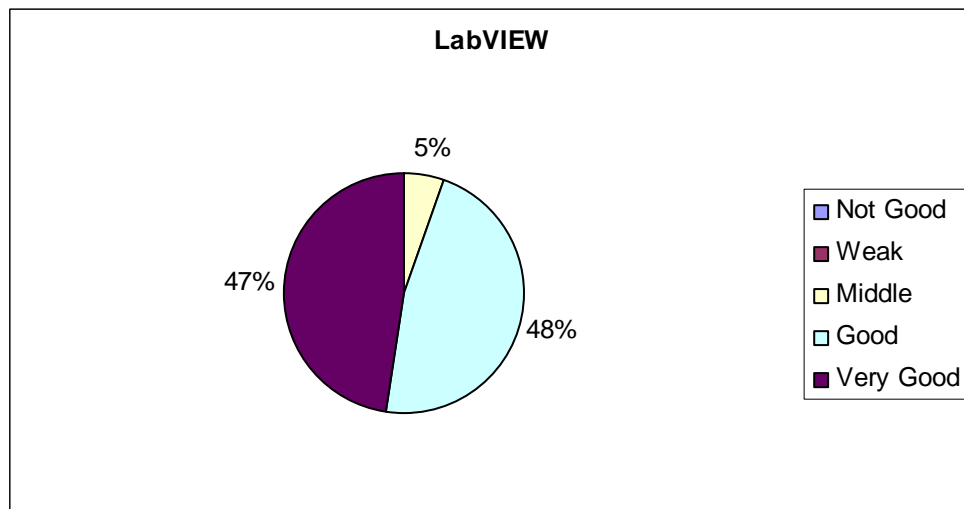


Figure 33. *LabView* Evaluation - *Promoting pupils' reflection* criterion

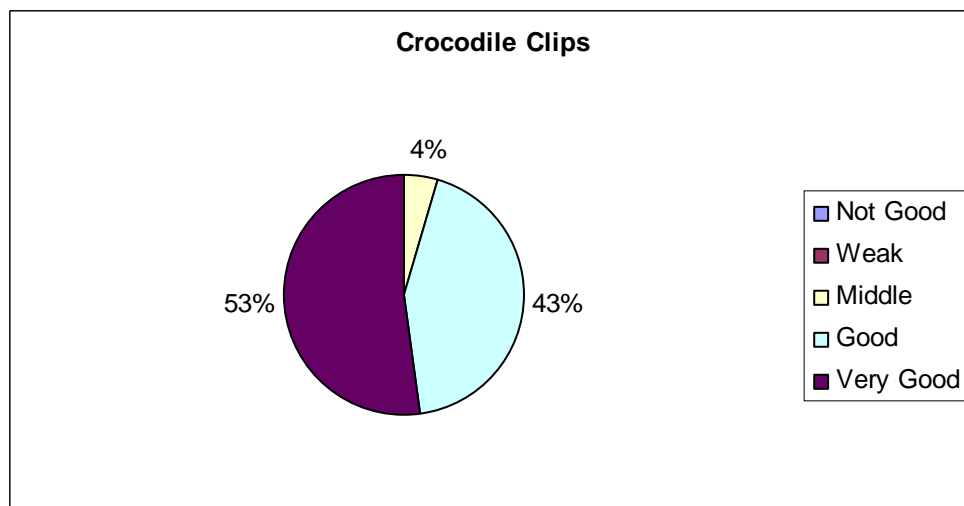


Figure 34. *Crocodile Clips* Evaluation - *Promoting pupils' reflection* criterion



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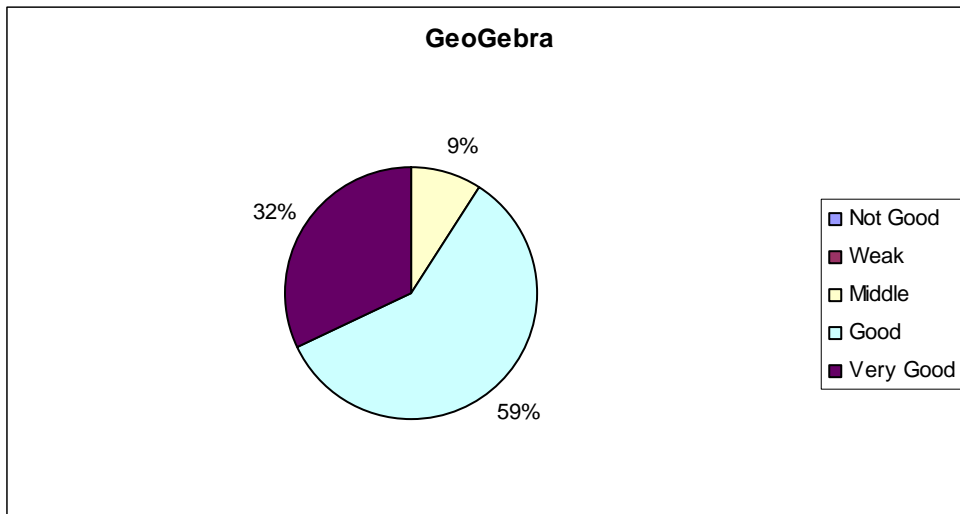


Figure 35. *GeoGebra* Evaluation - *Promoting pupils' reflection* criterion

8. Providing appropriate feedback

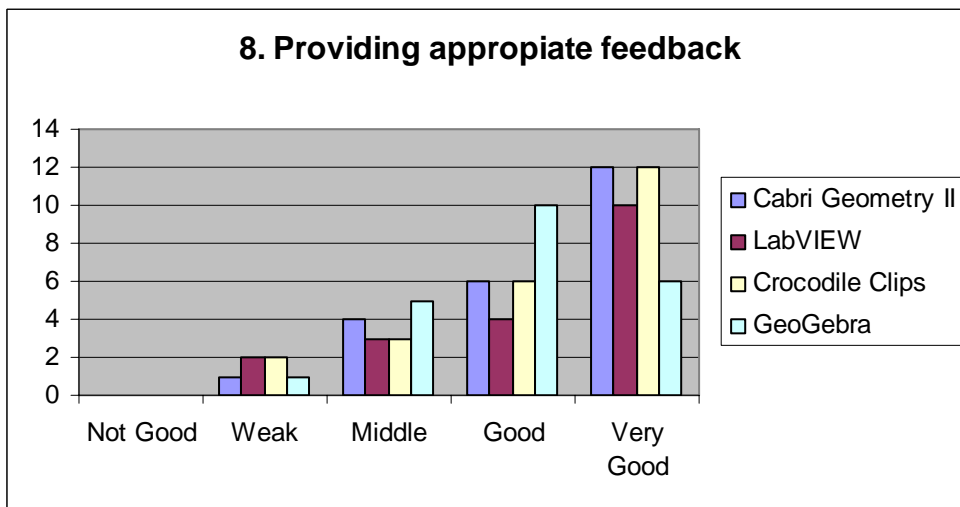


Figure 36. *Providing appropriate feedback* criterion



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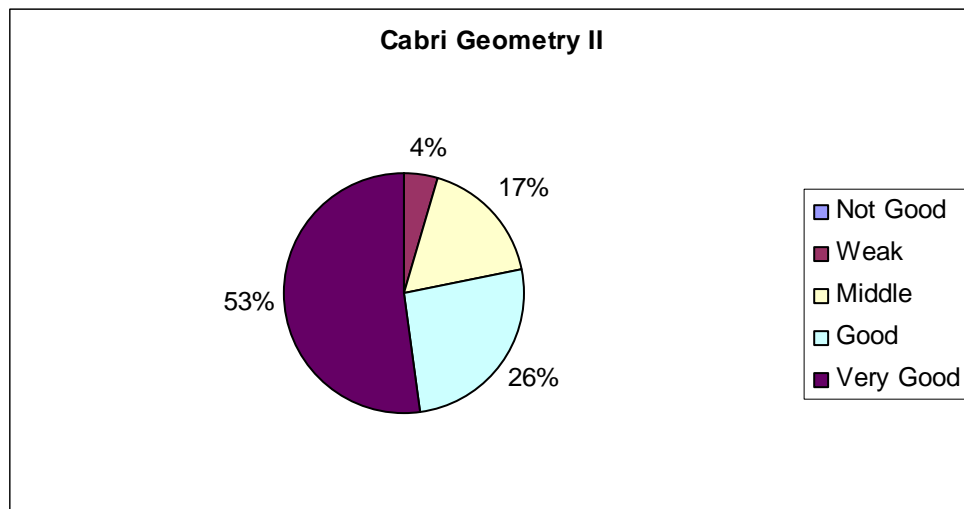


Figure 37. *Cabri Geometry* Evaluation - *Providing appropriate feedback* criterion

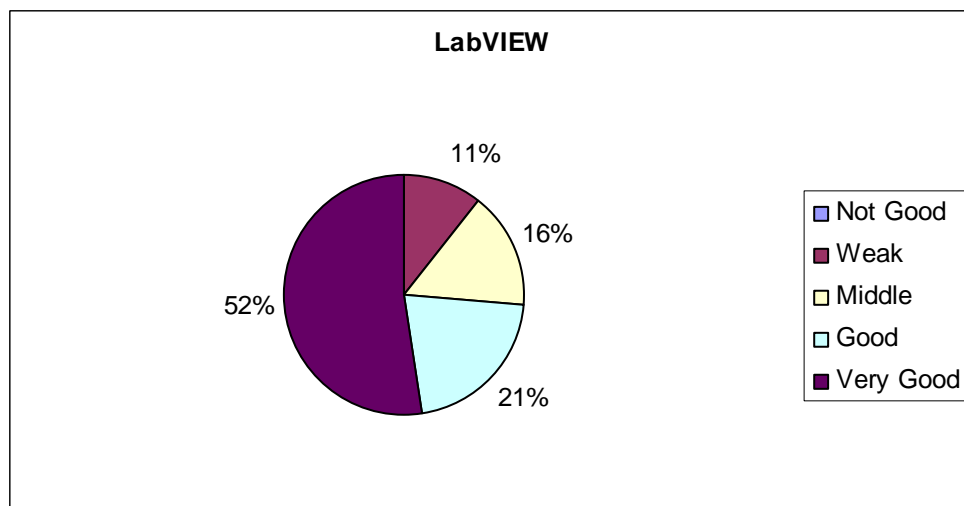


Figure 38. *LabView* Evaluation - *Providing appropriate feedback* criterion



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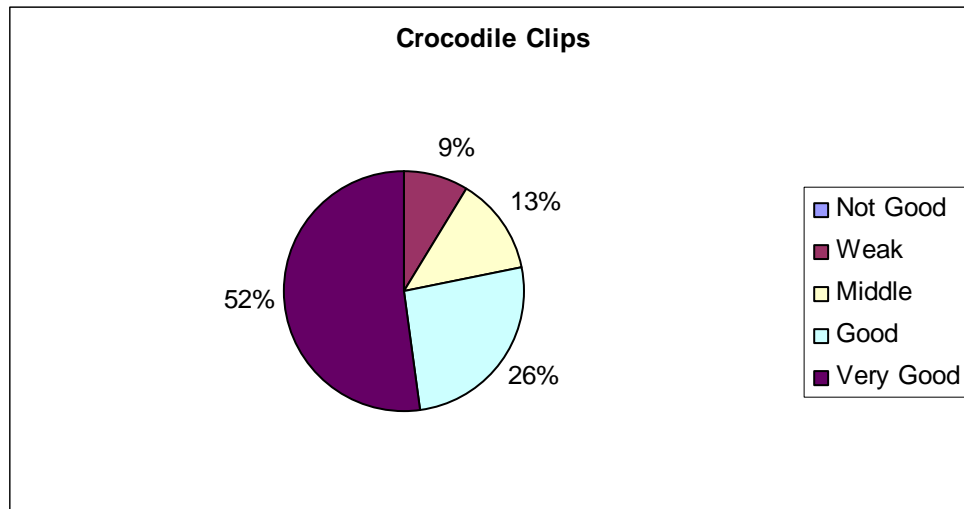


Figure 39. *Crocodile Clips* Evaluation - *Providing appropriate feedback* criterion

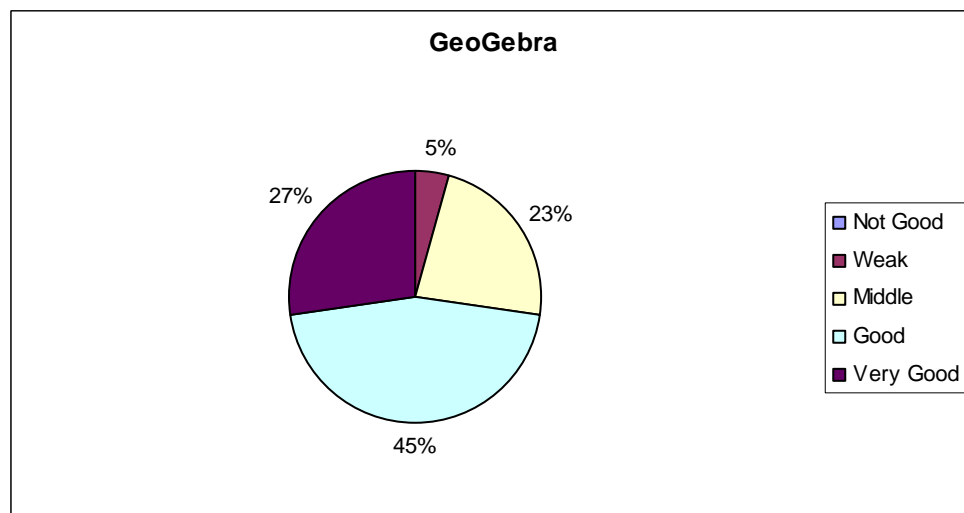


Figure 40. *GeoGebra* Evaluation - *Providing appropriate feedback* criterion



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9. Designing various activities

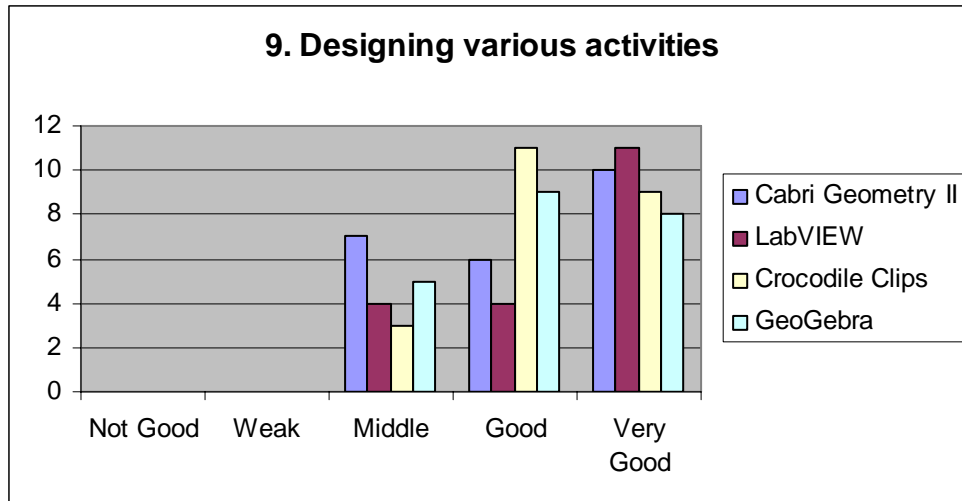


Figure 41. *Designing various activities* criterion

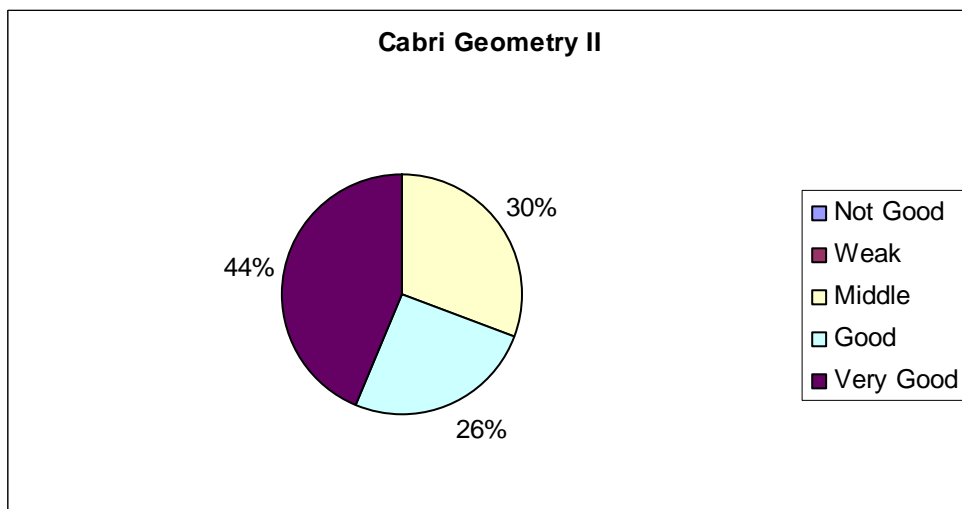


Figure 42. *Cabri Geometry* Evaluation - *Designing various activities* criterion



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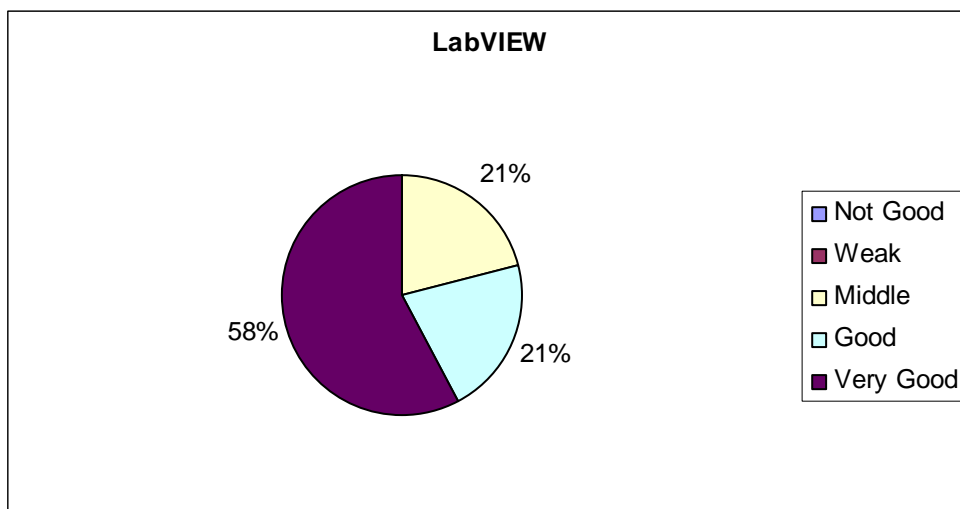


Figure 43. *LabView* Evaluation - *Designing various activities* criterion

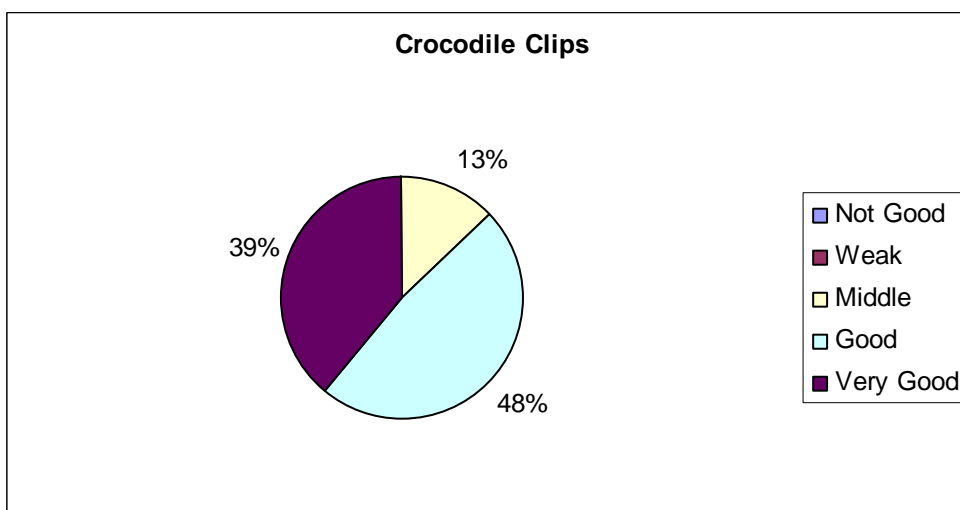


Figure 44. *Crocodile Clips* Evaluation - *Designing various activities* criterion



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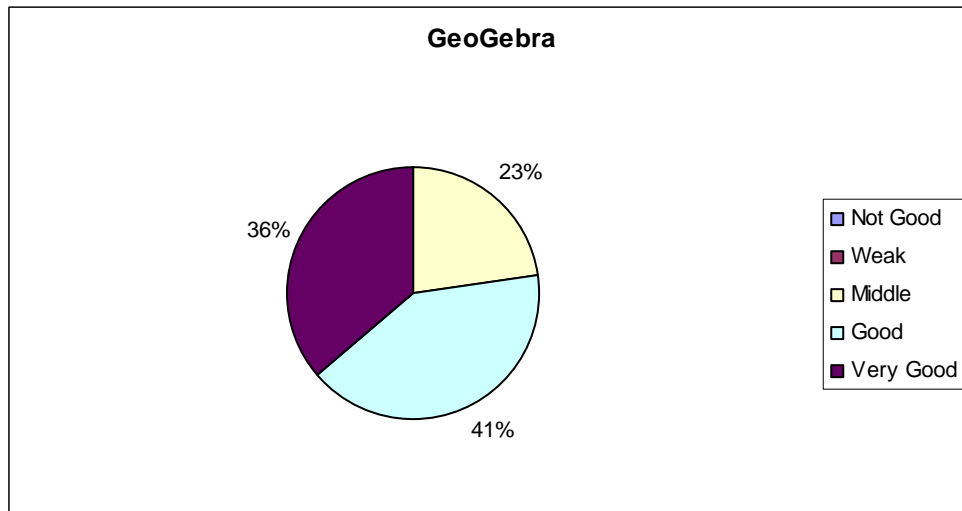


Figure 45. *GeoGebra* Evaluation - *Designing various activities* criterion

10. Concept/content teacher

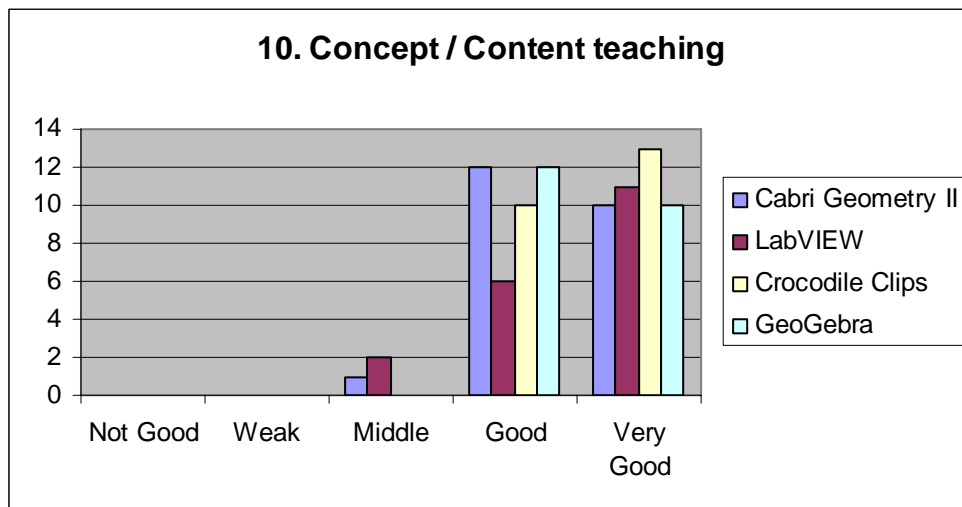


Figure 46. *Concept / Content* criterion



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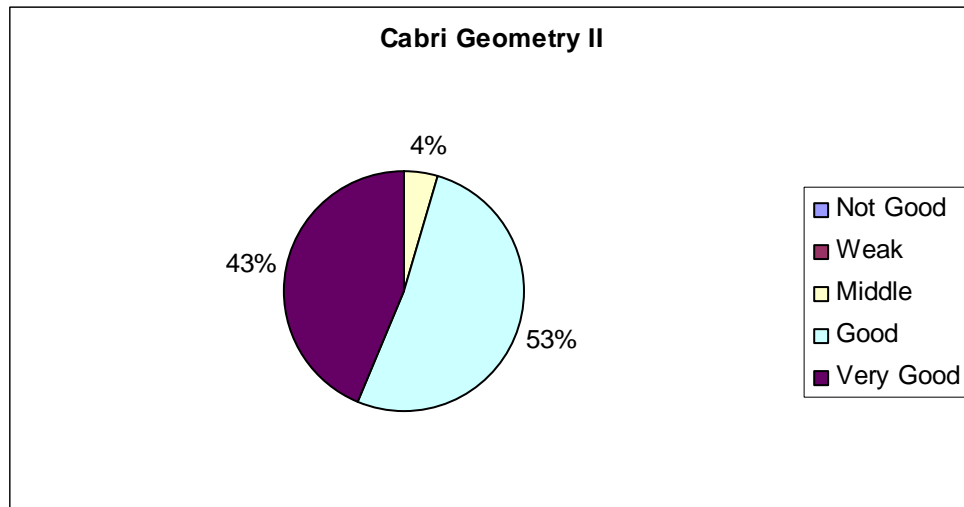


Figure 47. *Cabri Geometry* Evaluation - *Concept / Content* criterion

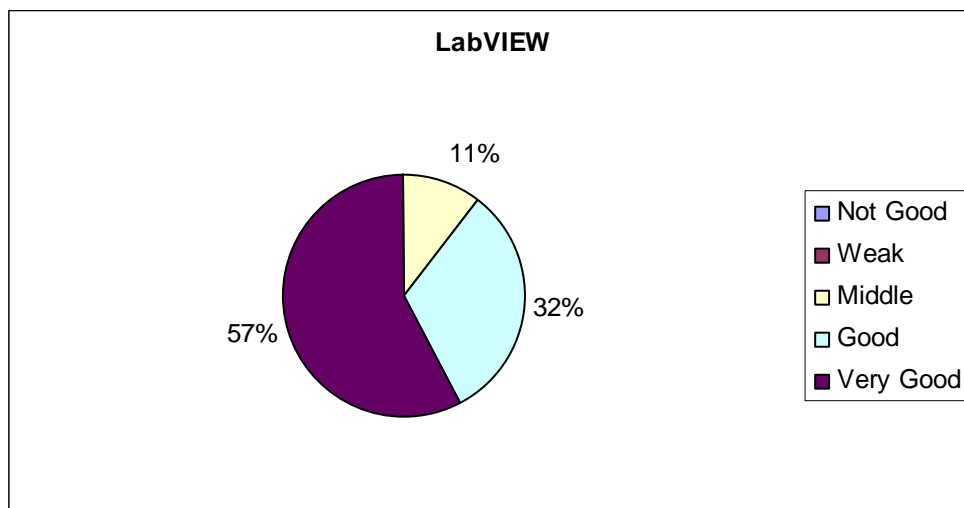


Figure 48. *LabView* Evaluation - *Concept / Content* criterion



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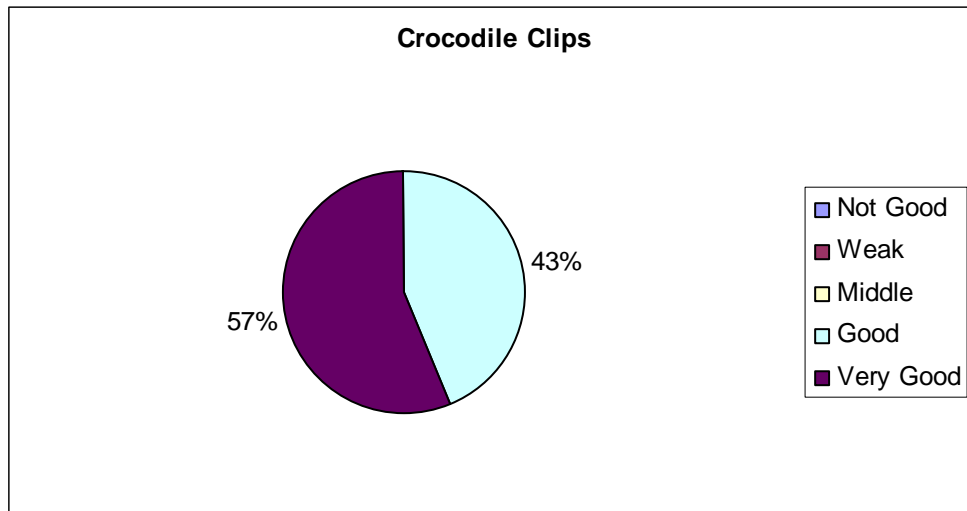


Figure 49. *Crocodile Clips* Evaluation - *Concept / Content* criterion

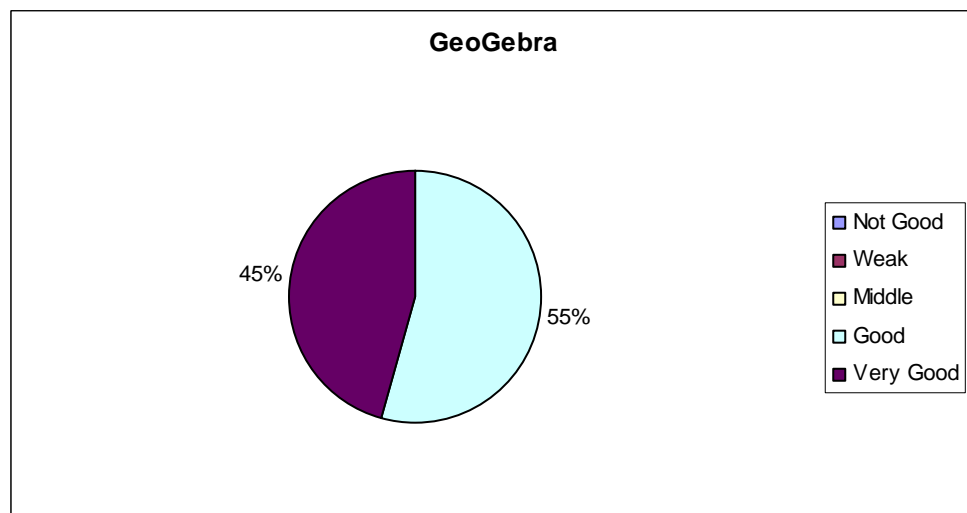


Figure 50. *GeoGebra* Evaluation - *Concept / Content* criterion

**“Virtual Instrumentation in Science Education”****C. Results**

In pointing out the strong and weak points of the software, the percentage gauge of the respective marks has been adopted here. Those criteria that got 50% and above of the “Very Good” marks are considered as strong points; on the other hand, the criteria that got more than 25% of “Middle”, “Weak” and “Not Good” marks are considered as weak points.

In order to make the overall evaluation of the software, the descriptive gauge has been replaced by numerical one according to the following: *Not good* - 0, *Weak* - 1, *Middle* - 2, *Good* - 3, *Very good* - 4.

In the overall evaluation, *Crocodile Clips* got the highest score by about 0.1 point than the other types of software but the score of which is almost the same.

Software	Strong points	Weak points	Overall score
Cabri Geometry	active learning, promoting pupils' reflection, providing appropriate feedback	collaboration, designing various activities	3.26
LabVIEW	active learning, expression of students' knowledge, interesting activities*, providing appropriate feedback*, designing various activities, concept/content teacher	usability, collaboration, interesting activities*, providing appropriate feedback *	3.25
Crocodile Clips	active learning, concept/content teacher, interesting activities, promoting pupils' reflection, providing appropriate feedback, concept/content teacher	collaboration	3.34
GeoGebra	usability, active learning	collaboration, providing appropriate feedback	3.25

(*) criterion chosen as a both strong and weak point

Using the same gauge, i.e. the percentage of the “Very Good” marks (in a given criterion, a software application got the highest percentage of “Very Good” answers/marks) the software that was evaluated as better in respective aspects can be pointed out:

Criteria	Software (according to descriptive marking)	Software (according to numerical marking)
usability	GeoGebra (50%)	GeoGebra (3.41)
collaboration	LabVIEW (21%)	LabVIEW (2.84)
active learning	Cabri Geometry (74%)	Cabri Geometry (3.70)
expression of students' knowledge	LabVIEW (58%)	LabVIEW (3.32)
holistic approaches in learning	Cabri Geometry, Crocodile Clips (43%)	Crocodile Clips (3.43)
interesting activities	Crocodile Clips (70%)	Crocodile Clips (3.61)

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promoting pupils' reflection	Cabri Geometry, Crocodile Clips (52%)	Crocodile Clips (3.47)
providing appropriate feedback	LabVIEW (53%)	Cabri Geometry (3.26)
designing various activities	LabVIEW (58%)	LabVIEW (3.37)
concept/content teacher	LabVIEW (58%)	Crocodile Clips (3.57)

Summing up: *LabVIEW* was the software application that got the highest score, because it was chosen in five criteria. The next ones are *Cabri Geometry* and *Crocodile Clips* (chosen three times). *GeoGebra* got the highest score for usability. Taking as a gauge the average score/rating of the chosen software (the software that got the highest score for a given criterion), *Crocodile Clips* was the most frequently chosen (4 times), then *LabVIEW* (3 times), the third one was *Cabri Geometry* (2 times) and the last one was *GeoGebra* (once only). In the case of both of the ways of evaluation the scores are almost identical.

For the overall evaluation of the software numerical scale was adopted. The differences among the scores are rather small (about 0.1), but nevertheless, *Crocodile Clips* got the highest score whereas the others with identical score were behind it.

D. Observations and Conclusions

In the evaluation of the criteria fulfillment/observation, numerical scale was adopted. The differences here are considerable (about 0.9).

	Criterion	Score
1.	Usability	3.17
2.	Collaboration,	2.75
3.	Active learning,	3.67
4.	Expression of students' knowledge,	3.20
5.	Holistic approaches in learning,	3.31
6.	Interesting activities,	3.43
7.	Promoting pupils' reflection,	3.39
8.	Providing appropriate feedback,	3.15
9.	Designing various activities,	3.22
10.	Concept/content teacher	3.47

As far as criteria are concerned “active learning” got the highest score, then “concept/content teacher” and “interesting activities”, whereas “usability” and “providing appropriate feedback” got lower score; “collaboration” got the lowest score. None of the criteria got “Not Good”. Similarly, “Weak” rarely occurred (0% - 11%).

All the average scores of the numerical criteria (except “collaboration”) as well as the software are placed between “Good” and “Very Good” on the descriptive scale. That means that the software can be regarded as good and useful for the didactic process.