CHEMY SHOOTER GAME BASED COMPUTER AS INSTRUCTIONAL MEDIA ON ACID BASE TO IMPROVE SELF-EFFICACY

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Abstract. *This study aims to obtain the advisability of game Chemy Shooter as instructional media on acid-base that can improve high school students self-efficacy skills. The game was feasible if fullfill 3 criteria that is validity, practicality, and effectiveness The validation assessment results obtained 90.79% had fulfilled the validity category. The results of questionnaire responses and observations of students activities gained 96.16% and 93.33% with the category of very practical. Student learning values in the Kolmogorov-Smirnov normality test obtained a pretest value of 0.200 and posttest 0.200 so that it is greater than 0.05 so that it is normally distributed and Paired Sample t-Test test obtained significant pretest and posttest 0.000 significant values are less than 0.05 so that there are differences in the average pretest and posttest scores and the results of students self-efficacy skills gained 89.20% in the very effective category.*

Keywords: *Chemy shooter game, self-efficacy, acid base*

INTRODUCTION

The development of science in the field of technology at this time humans have demands to get a better education. Education is the main factor of several factors that affect human life from one period to the next. Education is a certain method so that a person gains an understanding of knowledge, as well as how to behave [1]. The Government of the Republic of Indonesia has made many efforts to overcome all lags in the field of education, one of which is improving the education system by developing the 2013 Curriculum. 1) objectives, lesson materials, and content; 2) the learning activities used [2].

Chemistry learning is learning that exists in Upper Secondary School (SMA). Chemistry is a science in the form of facts, theories, concepts, scientific work, principles, and laws [3]. Acid base is a chemical material that studies the concept of acid base theory according to experts, calculating the pH and pOH of a base acid, acid base reactions, and acid base in daily life.

Based on the results of a questionnaire conducted at SMA Muhammadiyah 1 Surabaya and Madrasah Aliyah Negeri 1 Gresik, it was stated that as many as 62.96% and 65.62% of students experienced difficulties in acid-base chemistry. In addition, as many as 85.18 % and 75% of students still use blackboard media when explaining chemical material. The interview conducted on the chemistry teacher of SMA Muhammadiyah 1 Surabaya stated that the level of difficulty of the acid-base material for students was obtained from the results of the students' scores which were classified as difficult because of the many sub-materials and the existence of calculations, this made the grades on the acid-base material complete with remedial grades.

The achievement of learning outcomes for students is related to obtaining abilities in accordance with the specific objectives that have been planned [4]. The process of learning and teaching learning media is able to motivate, new interests, provide psychological influence, arouse desire, and stimulate learning activities [5]. Learning media has several factors that determine whether or not a medium is used, namely; 1) learning

objectives, 2) learning materials, 3) theories used 4) student characteristics 5) learning styles, and 6) supporting facilities, time, and environmental conditions. [6].

The result of modern technology that opens the greatest possibility of learning media, namely computers. Computers have proven its benefits to help students to learn [7]. In learning the use of computers, the ability to read, write, understand information in the form of signs, writing, sound, and visuals is effective. *" Multimedia in the Classroom"*, has carried out one program, namely a game through a computer which is described by the way a student presses the button, a question will appear that will activate the thinking process of students who press the button [8].

Games as learning media have their own advantages over other learning media [9]. These advantages, namely; 1) the participation of students to learn, 2) the game is something that is entertaining and interesting, 3) is flexible which is useful in various kinds of education [10]. The main goal of most games is not to forbid failure but to develop a positive relationship with it. Failure is not seen as the end, but as a step on the way to mastery [11].

The results of the questionnaire at SMA Muhammadiyah 1 Surabaya and Madrasah Aliyah Negeri 1 Gresik showed similarities that in SMA Muhammadiyah 1 as many as 88.88% and Madrasah Aliyah Negeri 1 Gresik as many as 100% of students wanted to learn chemistry by using computer-equipped media in the form of games. Apart from learning media, if someone has strong *self-efficacy*, they will be more confident in their ability to act. One's belief in thinking, motivating oneself feel, as well as the way of behaving is called *Self-efficacy* [12]. Based on the results of a *self-efficacy questionnaire* conducted at SMA Muhammadiyah 1 Surabaya and Madrasah Aliyah Negeri 1 Gresik, there are similarities in both, namely from the *magnitude dimension* as much as 64.81% and 69.53% of students easily give up when experiencing some difficulties in understanding acid-base material. On the *strength* dimension as much as 83,33% and 86.71 % of students cannot complete the task without guidance or assistance from others. In addition, on the *generality dimension*, 63.89 % and 74.21% of students cannot complete the task on time. From the results of the *self-efficacy questionnaire, it was* found that the average *self-efficacy value* at SMA Muhammadiyah 1 Surabaya was 65.48% and Madrasah Aliyah Negeri 1 Gresik received a score of 71.37%. These results prove that the level *of self-efficacy* of students is still relatively low, so *self-efficacy* needs to be improved again. In the students' self basically stored *self-efficacy skills*. But how to make *self-efficacy* in students can be explored. Based on the results of this description, so that expectations can be achieved, a research was conducted on the computer- *equipped Chemy Shooter game* as a medium for learning acid-base material to increase *self-efficacy*.

METHOD

This type of research follows the Research and Development (R&D) development plan consisting of 10 stages, namely; 1) potential and problem analysis, 2) data collection, 3) product design, 4) design validation, 5) design revision, 6) product trial, 7) product revision, 8) usage trial, 9) product revision, and 10) mass production [13]. However, this research was limited to product trials. *The Chemy Shooter* game media was tested limited to 15 students of SMA Muhammadiyah 1 Surabaya. The design is illustrated in the following flow chart.

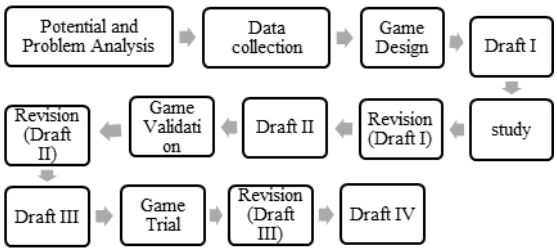

Figure 1. Flowchart in the game *Chemy Shooter*

The explanation of the flow chart above is as follows.

The first stage of potential and problems, this stage aims to identify initial problems in the field. Ways to identify problems are distributing research questionnaires and *self-efficacy questionnaires* to students, as well as conducting interviews with chemistry teachers.

The second stage of data collection, the results of the potential and problem stages

need to be developed for the game on acid-base material so that the next step is collecting data to develop the *Chemy Shooter game* in the hope of solving the problem. Collecting data to develop the *Chemy Shooter game* related to the material loaded according to KI and KD guided by the revised 2013 curriculum, making indicators and objectives to adapt to KI and KD, designing a grid of materials and questions contained in the *Chemy Shooter game*.

The third stage of game design, game design is used to design *flowchat* and *storyboards* (Draft I). Then it is given to the reviewers, namely lecturers in the fields of media and chemistry to get suggestions and comments so that the media plays according to the specified category, then Revised Draft I is carried out.

The fourth stage is game validation, this stage is to assess draft II which has been reviewed and revised. Draft II will be assessed by experts in the field of media and chemistry using a validation sheet. The assessments obtained are interpreted into categories in Table 1.

Table 1. Game Validator Interpretation Category

Score	Category
1	Not very good
2	Not enough
3	Enough
4	Well
5	Very good

The following is the formula for calculating the validator value data that has been obtained.

$$\text{Percentage (\%)} = \frac{\text{jumlah skor hasil}}{\text{Skor Kriteria}} \text{x } 100\%$$

With description:

Category Score = Highest score of each item x $\sum$ item x $\sum$ validator

Furthermore, the results of game validation by the validator are interpreted into categories in Table 2.

Table 2. Category of Game Validity Result Interpretation

Percentage (%)	Category
0-20	Totally invalid
21-40	Not valid
41-60	Quite valid
61-80	Valid
81-100	Very valid

After getting the validation results, draft II was revised to improve the *Chemy Shooter game media* (Draft III).

The fifth stage of the game trial, this stage is to find out the practical and effective media of the Chemy *Shooter game.* After getting the results of practicality and effectiveness, the next step is to revise draft III so that appropriate learning media are produced. Then revised again the results of the trial revision is called Draft IV.

Practicality is obtained from response questionnaire data and student activity observations. In the response of students, an assessment can be made based on the Guttman scale in Table 3.

Table 3. Guttman Scale Score

Answer	Positive statement score	Negative statement score
Yes	1	0
Not	0	1

In the student's response, the data was obtained using the following formula.

$$P = \frac{\text{jumlah respon tiap pertanyaan}}{\text{jumlah responden}} \text{x } 100\%$$

Chemy Shooter game is said to be good as a medium in learning at ≥61% achievement.

In observing the activities of students, the data used the following formula.

$$P = \frac{\sum \text{Aktivitas yag muncul tiap aspek}}{\sum \text{Aktivitas yang muncul keseluruhan}} \; x \; 100\%$$

The *Chemy Shooter game* is declared good

if the relevant activity is higher than the irrelevant activity with an achievement percentage of ≥61%.

Chemy Shooter games are said to be practical if they get an achievement percentage of ≥61%.

Effectiveness is obtained from data on learning outcomes and *self-efficacy skills* of students. The learning outcomes were analyzed by normality test to find out the *pretest* and *posttest scores* were normally distributed and the t-test was based on the difference between the average *pretest* and *posttest scores* calculated using SPSS *software version 22 for windows*. The following is the formulation of the hypothesis test:

H_0 : *Pretest* data have normal distribution

H_1 : *Pretest* data not normally distributed

Furthermore, the criteria for rejecting and not referring to the *Kolmogorov-Smirnov test.*

If with $K_{s\ count}$, then $H0_{\ is}$ accepted

If with $K_{s\ table} < K_{s\ count}$, then $H_{0\ is}$ rejected

The t-test uses *Paired Sample T-Test* with the following hypotheses:

H_0 : There is no difference in the average *pretest* and *posttest scores*

H_1 : There is a difference in the average *pretest* and *posttest scores*

Furthermore, in testing the hypothesis, the criteria for rejection and acceptance are based on the *Paired Sample t-Test*.

If $t_{tabel} \geq t_{hitung}$, then $H_{0\ is}$ accepted

If $t_{tabel} \leq t_{hitung}$, then *H0 is* rejected

Learning outcomes are supported by data on self-efficacy skills on a *self -efficacy* sheet that includes 3 dimensions, namely *magnitude*, strength, and *generality*. Assessment is done by analyzing the answers of students when using the *Chemy Shooter game media* according to the rubric that has been provided. The data obtained is calculated by the following formula.

$$\textit{Self efficacy}\ \text{value} = \frac{\textit{Skor yang diperoleh peserta didik}}{\textit{skor maksimal}} \times 100\%$$

The *Chemy Shooter game* is said to be effective if it has an achievement percentage of ≥61%.

RESULTS AND DISCUSSION

The following is obtained the results of research analysis on the development of the computer-based *Chemy Shooter game* as a medium for learning acid-base material to increase *self-efficacy*.

Game validation

Chemy Shooter game is based on content and construct validity aspects. Here is a picture of the initial appearance of the *Chemy Shooter game*

Figure 2. The initial appearance of the *Chemy Shooter game*

The assessment was carried out by three validators from two lecturers and one teacher in the field of chemistry which are presented in Table 5.

Table 5. Results of Content Validation and Game Construction

No.	Aspects	P (%)	Categories
	Content Validation		
1.	The truth of the concept	86.67	Very good
2.	The suitability of the material in the game with the purpose	76.66	Good
	On average	81.65	Very good
	Construct Validation		
1.	Features of the IPA	93.33	Very good
2.	Encourage the development of special skills	93.33	Very good
3.	Conformity with the characteristics of learners	90	Very good

No.	Aspects	P (%)	Categories
4.	Have rules	100	Very good
5.	Guiding nature	100	Very good
6.	The existence of competition requirements and strategies in playing	100	Very good
7.	Challenging and engaging active learners	93.33	Very good
8.	Give feedback	93.33	Very good
9.	Has an element of decision making	96.66	Very good
10.	Game media display	84.44	Very good
11.	Software engineering	80	Well
12.	Audio-visual communication	83.33	Very good
	Average	86.25	Very good

Based on the results of Table 5, the validity of the *Chemy Shooter game*, the content validation aspect, obtained a percentage of 81.65 %. In the first aspect, namely the correctness of the concept, a high score was obtained with a percentage of 86.67 % which shows that the content of the material is in accordance with the rules of chemistry. This is in accordance with relevant research that the material in the learning media is in accordance with the objectives of KI, KD, and indicators [6]. While the second aspect is the material in the game with the aim of obtaining a lower score, a percentage of 76.66 % is obtained, this is because there are some materials and videos that are not appropriate for the purpose of learning so that it needs to be improved. *Chemy Shooter* game comes with video. The existence of a video in the game can make it easier to understand the material. This is in accordance with the results of relevant research that video games as the main driver make students interested in learning [14].

In construct validation, the percentage is 86,25 %. In the fourth aspect, namely having rules, the fifth aspect is guiding, and the sixth aspect is competition in terms of requirements and strategies in playing, each of which gets a high score with a percentage of 100%. This is in accordance with relevant research that the game as a system for players to engage in conflict that has been determined by the rules [11]. In addition, in the game there is feedback, decision making, and responsibility [15]. While the eleventh aspect gets the lowest score with a percentage of 80%, this is because the *Chemy Shooter game* has a size of 635 KB.

Based on the validation results, which consist of content validation and construct validation, *Chemy Shooter* has met the validity category by obtaining an achievement percentage of ≥61%.

Practicality

The practicality of the *Chemy Shooter game* is obtained through the results of responses and observations of student activities. The results of student responses obtained through student assessments after using the game are presented in Table 6.

Table 6. Student Response Results

Aspect	P(%)	Category
Knowing students' interest in the game *Chemy Shooter*	95.00	Very good
Knowing the level of ease of use of games as a medium for learning acid-base materials	97.33	Very good
Average	96.16	Very good

Based on the results of Table 6 the assessment obtained a percentage of 96.16 % . In the first aspect, the percentage of 95% is because the *Chemy Shooter game media* attracts the attention of students to understand acid-base material. This is in accordance with relevant research that the game provides a satisfying learning experience for students after achieving the goals in accordance with expectations [16]. Games make chemistry more fun and students agree that games are used as a medium of learning in the classroom because learners are motivated to learn [17,18]. In the second aspect, the score is

higher than in the first aspect with a percentage of 97.33%, it shows that students have no difficulty in installing game *software*, operating the game, the language in the game is easy to understand. According to relevant research, the content of the media must be arranged in good language, because it is useful for conveying learning messages [19].

The data from the response questionnaires were supported from the results of observing the activities of students through observer observations while using the *Chemy Shooter game* every 3 minutes for 15 observations. Observations were made by 1 observer which is presented in Table 7.

Table 7. Results of Observation of Student Activities

Aspect	P(%)
The interest of students when using the *Chemy Shooter game*	40.00
Participants' learning activities using the game *Chemy Shooter*	53.33
Activities irrelevant to the game *Chemy Shooter*	6.67
Total	100

Based on Table 7 the results of observing student activities as much as 6.67% of the total time, students doing activities that are not relevant to the *Chemy Shooter game* and relevant activities carried out by students with the longest time, namely learning to use the *Chemy Shooter game* get a percentage of 93, 33%. In the first aspect, namely the interest of students when using the *Chemy Shooter game*, the overall time obtained a percentage of 40%, this shows that the *Chemy Shooter game* makes students interested in learning while playing. These results are in accordance with relevant research that the entertaining nature of games makes students learn while learning have fun so as to encourage active involvement of learners and motivate learners to continue learning [14,20]. In the second aspect, namely the learning activities of participants using the *Chemy Shooter game*, the overall time obtained a higher score than the first aspect with a percentage of 53.33%, this shows that students are very actively involved with the *Chemy Shooter game media*. This is in accordance with relevant research that involves active students by directly playing and solving problems at each level [21]. In the *Chemy Shooter game* there is a video of acid-base material to make it easier for students to understand the material. This is in accordance with relevant research that games and videos can motivate and encourage positive progress of students [22].

The *Chemy Shooter game* has met the practicality category by obtaining an achievement percentage of ≥61%.

Effectiveness

Effectiveness is obtained from data on learning outcomes and *self-efficacy skills* of students.

Student learning outcomes are presented in Table 8.

Table 8. Student Learning Outcomes

Condition	Score average –	Lowest value	Score highest	Number of Students
Pretest	61	40	80	15
Posttest	84	70	100	15

Then the data obtained were analyzed for normality tests based on the results of calculations using SPPS *version 22. software forwindows* obtained an output that refers to the *Kolmogorov-Smirnov test* with a significant level of 0.05. The test results are presented in Table 9.

Table 9. *Kolmogorov-Smirnov* Test Pretest and *Posttest*

One-Sample Kolmogorov-Smirnov Test		
	Pretest score	Posttest score
N	15	15
Kolmogorov-Smirnov Z	.123	.181
asymp. Sig. (2-tailed)	.200	.200

Based on the results of Table 9, a significant value was obtained referring to the *Kolmogorov-Smirnov. test pretest* and *posttest* of 0.200. The result of a significant value greater than 0.05 means that the results of the *pretest* and *posttest* are normally distributed so that a t-test can be performed. The analysis of the results of the *pretest* and *posttest* refers to

the *Paired Sample t-Test test* with a significant level of 0.05. The test results are presented in Table 10.

Tabel 10. Result of *Paired Sampel t-Test*

	t	df	Sig. (2-tailed)
Pair 1 skor pretest - skor post	-14.343	14	.000

Based on Table 10 shows that the significant value of *pretest* and *posttest* is 0.000. The significant value of the *pretest* and *posttest data* is less than 0.05, so there is a difference in the average *pretest* and *posttest scores* so that the game media has an effect on learning outcomes. These results are in accordance with the results of relevant research. Games are used as intermediaries in learning and after using computer-based game media, it has a positive influence, namely student learning outcomes can increase [23,24, 25].

Data from learning outcomes are supported by data on *self-efficacy skills*. Data on *self-efficacy skills were obtained from self-efficacy* sheets by analyzing students' answers when using the *Chemy Shooter game as* the media. The results of *self-efficacy* skills are presented in Table 13.

Table 11. Results of *Self-Efficacy Skills*

Dimension	P(%)	Category
Magnitude	88.95	Very good
Strength	91.26	Very good
Generality	87.40	Very good
Average	89,20	Very good

Based on Table 11 the results of *self-efficacy skills* by analyzing students' answers while using the Chemy *Shooter game*. *In the magnitude* dimension by analyzing behavior, students can solve problems in games that have low, medium, and difficult levels of difficulty correctly obtaining a percentage of 88.95 %. When solving questions, students answer questions one to two times to get the correct answer. These results show that students can solve problems at each level with different levels of difficulty correctly even though it is done with two repetitions. On the *strength* dimension by analyzing behavior, that is, students can solve problems in the game correctly without help from others (levels 1, 2, and 3), obtaining a percentage of 91,26 %. When working on the questions in the *Chemy Shooter game*, students work on their own, even if they repeat the answers more than once. This shows that students are able to solve problems in the *Chemy Shooter game* without help from others. In the *generality* dimension by analyzing behavior, students can solve problems in the game with the specified time (levels 1, 2, and 3), obtaining a percentage of 87.40 %. When working on questions, the time required for students to solve problems is 15-60 seconds. This shows that students can complete the questions on time. The average result from the aspect of *magnitude*, *strength*, and *generality* obtained a percentage of 89 ,20 %. This shows that using the *Chemy Shooter game* makes students experience an increase in *self-efficacy*. Judging from the initial results of the study, the average *self-efficacy value* of students was 65.48 %. The *Chemy Shooter game* has met the effectiveness category by obtaining an achievement percentage of ≥61%. If the teacher implements a positive teaching method, students can develop a strong sense of *self-efficacy* in themselves [12].

These results prove that the *Chemy Shooter game is* effective as a learning medium to improve *self*-efficacy *skills* on acid-base materials. According to Niveen , learning media is said to be feasible if it meets the criteria of validity , practicality, and effectiveness [26].

CONCLUSIONS AND SUGGESTIONS

Based on the discussion obtained, it is concluded that the results of the research on the computer- *equipped Chemy Shooter game* on acid-base material to improve *the self-efficacy* of SMA Eligible students as learning media by meeting the criteria of validity, practicality, and effectiveness are described below.

1. The results of the validation of the *Chemy Shooter game* seen from the content validation results obtained a percentage of 81.65% and constructs obtained a percentage of 86.25 %. The content validation and construct validation aspects of the *Chemy Shooter game* have met the valid category as a learning medium with

an achievement percentage of ≥61%.

2. The results of the practicality of the *Chemy Shooter game* from the students' responses obtained a percentage of 96.16 %. Supported by the results of observations of student activities, the percentage of students is 93,33 %. The *Chemy Shooter game* has met the practicality category by obtaining an achievement percentage of ≥61%.
3. The results of the effectiveness of the *Chemy Shooter game* seen from the learning outcomes of students with a significant value of the *Kolmogorov-Smirnov test* obtained a significant value of *pretest* and *posttest* of 0.200. The significant value is more than 0.05 indicating a *normal* distribution. Meanwhile, in the *Paired Sample t-Test, the pretest* and *posttest* significant scores were 0.000. The data was less than 0.05, indicating that there was a difference in the average *pretest* and *posttest scores*. Learning outcomes are supported by the results of *self-efficacy skills* obtaining a percentage of 89.20 %. The *Chemy Shooter game* has met the effectiveness category by obtaining an achievement percentage of ≥61%.

Based on the results of the study there are suggestions from researchers. The suggestion is that teachers can use games as learning media in the classroom so that students are interested and increase interest in learning so that students are actively involved when learning in today's digital era.

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