International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Developing Science Learning Devices Based on Self-Regulated Learning Model to Improve Scientific Literacy and General Life Skill

WindaFitrifitanofa[a], Jumadi[b*], InsihWilujeng[c], Senam[d]

[a]*Graduate Student of Science Education Program, Yogyakarta State University, Indonesia*

[b,c,d]*Science Education Program of Study, Graduate Program, Yogyakarta State University, Indonesia*

[a]*Email: windafitrifitanofa@gmail.com*

[b]*Email: jumadi@uny.ac.id*

[c]*Email: insih@uny.ac.id*

[d]*Email: senam@uny.ac.id*

Abstract

This study aims to: (1) produce a feasible science learning devices based on MSRL; (2) investigate the effectiveness of developed science learning based on MSRL in this research towards the improvement of scientific literacy (SL) and General Life Skill (GLS) of the junior high school students. This is a research and development research employing [2] model. Research procedures cover (1) preliminary study, (2) product design, (3) validation, (4) field test and product revision that produce the final product. The MSRL-based science learning devices consists of Lesson Plan (RPP), Student Worksheet (LKS) and Authentic Assessment Instrument (IPO). The result of the study is a MSRL-based science learning devices for the seventh grade of junior high school students which is effective in improving the students' SL and GLS. Based on the experts' assessment, the product is considered very feasible to use. The effectiveness of the learning devices in improving the students' SL ability can be seen from the comparison of normalized gain score between the control class and the experiment class which are 0.57 and 0.61.

---

* Corresponding author.

The comparison of the students' GLS normalized gain average between the control class and the experiment class also shows that the experiment class has higher normalized gain compared to the control class, which is 0.60 compared to 0.46. The T-Test Independent-Samples test result shows that the MSRL-based learning devices gives significant effect towards the SL and GLS improvement of the junior high school students.

Keywords: Science learning devices; self-regulated learning model; scientific literacy; general life skill.

1. Introduction

If possessing the competence and skills, abundant human resource will be a tremendous development capital. In contrast, they will be a burden if they do not have the competence and skills. The major challenge is how to strive for the abundant productive age human resource to be transformed into human resource who have the competence and skill. One effort that can be done is through education.

The globalization era requires rapid changes related to environmental issues, technological advances and information, the rise of the creative and cultural industries, and the development of education at the international level. This will shift the society's lifestyle from agrarian and traditional commerce into an industrial and modern commerce society. This future challenge demands Indonesian people to master various competencies according to the demands of the 21st century and has a high cognitive level.

21st century also demands Indonesian people to have a high cognitive level, through the mastery of Literacy in Mathematics, Reading, and Science in order to successfully compete in the future. Based on PISA (Program for International Student Assessment) international study, the average Science Literacy capability of Indonesian children since 1999 showed not encouraging result in recent issued reports. OECD data showed that the PISA results in 2012 put Indonesia in the 64th rank out of 65 participating countries [6]. The materials used in the measurement was the literacy skills related to science, reading and counting. The data illustrates that education in Indonesia is still far behind compared to other member countries of OECD [5]. Necessary reformation in education is needed, especially a curriculum that covers all aspects of the learning implementation.

Future competences that are needed to face globalization are those related to the ability to communicate, the ability to think clearly and critically, the ability to consider the moral aspect of a problem, the ability to become responsible citizens, the ability to try to be understanding and tolerant of different views, and the ability to live in a globalized society. Besides, Indonesian generation should also have a broad interest in life, have the readiness to work, have the intelligence according to their talents / interests, and have a sense of responsibility and leadership to the environment. (Kareulik et al, 2013, p.130) states that the 21st century competencies that must be mastered by students are divided into three namely foundational knowledge (to know), meta knowledge (to act) and humanistic knowledge (to value).

Learning in the 21st century requires students to master a variety of 21st century competencies to be successful in the future. One important skill for students to master is Humanistic Knowledge. Components of Humanistic Knowledge are Life Skills, Job Skills and Leadership which are needed so that students have the provision for overcoming and solving life's problems as an independent person, society and citizen. According to Sri

Handayani (2009), elementary school until senior high school should be able to provide supplies in general life skills for students, since only 30% continue their studies up to college, and 70% of them choose to work. Life Skills, Job Skills and Leadership must be procured so that students who choose to work have the required competencies needed by the society so that they can be absorbed in the working field and reduce unemployment. For those who continue their study, the Life Skills, Job Skills and Leadership can optimally equip the students to excel at the next level.

Due to the urgent demands of the 21st century and the scientific literacy (SL) ability, the government made a new policy in education. The policy was made by making changes from 2006 curriculum to the 2013 curriculum. The 2013 curriculum development was an attempt to enhance the mindset of the pattern of education in Indonesia.

The government's move to improve the quality of education in Indonesia is good enough by issuing the new curriculum, which is the 2013 curriculum focusing on interesting and interactive learning, scientific approach model (science teaching) so that students feel the meaningfulness of learning, and the student centered learning, but its implementation in the field are still having.

Some problems, 2013 curriculum development in 2013 only reached 40% of the socialization phase [4]. Levels implementing the 2013 curriculum are only the fourth grade, the seventh grade, and cthe tenth grade in 2013. The 2013 curriculum itself is planned to be implemented in all levels of education in 2018. Therefore, it is currently still in the phase of field test in the pilot project schools.

In the implementation, the teaching learning strategies should be planned as best as possible so that the obtained results will be optimal. Learning devices can help teachers to be able to plan learning more effectively and in accordance with the characteristics expected by the 2013 curriculum. Those characteristics are scientific approach based learning, student-centered learning, integrated thematic learning, interactive and engaging learning and authentic assessment. Conditions in the field indicate that teachers still have difficulty to pack the learning devices according to the characteristics of the 2013 curriculum.

The scientific approach based and student-centered learning process have not been able to be fully implemented in learning. Teachers still have difficulties in applying the scientific approach, because not all of the materials are easy to be delivered with such an approach. (Akgul, 2004, p.58) states that the scientific approach is the dimension in scientific literacy on the scientific inquiry that require students to understand the scientific approach for the investigation.

During the learning process, the materials taught were also not in accordance with the needs of society and less close to everyday life. Students are expected to have the skills that match the conditions of the society in their neighborhood. Therefore, students are not only expected to be theoretically intelligent, but also able to apply the knowledge they have in life. Science learning is closely related to our daily lives, so that they should fully understand the materials they study and its associations with life. Students who have this capacity are included in a group of students who are scientifically literate or have a high scientific literacy.

The application of student-centered learning is still difficult to implement in learning, because teachers are still used to the old pattern, which is teacher-centered learning. Moreover, it is still difficult for junior high school students to learn independently, so that the scientific approach and student-centered learning are still difficult to implement. Teachers need a lot of references about the learning models and methods to enable the students and put the teacher as facilitator. According to Santyase (2013, p.10), the learning model has a big influence during the learning process. The abilities that the students are expected to have are determined by relevance of the use of a learning model that fits the standard of success in the learning objectives.

According to Zumbrunn et.al. (2011), MSRL is a process of learning that guides students in organizing thoughts, behaviors, and emotions to get a successful learning experience. Cycles in MSRL consist of Forethought and planning, performance, and self-reflection. Based on the cycles and MSRL special feature, this model is suitable to use for applying the scientific approach, student-centered learning and provide the general life skills (GLS) in learning because students are required to be active.

From the preliminary study (needs assessment) conducted in several junior high schools in Central Java and Yogyakarta, it was found that there were some problems related to the implementation of 2013 Curriculum in the pilot project and non-pilot project schools (WindaFitrifitanofa, 2014: 198). Conditions in the field indicate that teachers still have difficulties in implementing 2013 curriculum in the learning process. It made the government change the implemented curriculum in schools from 2013 curriculum into KTSP; and only the pilot project schools may implement the 2013 curriculum. Non pilot project schools can implement KTSP only until the academic year of 2019/2020 (Permendikbud No. 160 of 2014). Permendikbud No. 160 of 2014 also mentions that the basic education unit and secondary education that have not implemented 2013 curriculum should get training and assistance for the head of the education unit, teachers, staff, and the superintendent of the education unit. A ready to use learning devices is needed to facilitate the school in the process of preparation for the implementation 2013 curriculum, which is the academic year of 2020/2021 at the latest. Therefore, a research entitled "Developing a Science Learning Devices Based on Self-Regulated Learning Model to Improve Scientific Literacy and General Life Skills of the Seventh Grade of Junior High School Students" was conducted.

The background issues were identified into several problems including: (1) The necessity of learning that can improve students' SL due to the low performance on the report result of Pisa 2012 [6] which was 64th rank out of 65 countries, (2) 21st Century competencies integration which is GLS is needed through a particular learning model particular to overcome the number of productive age population that is not absorbed in the working world, (3) the implementation of 2013 curriculum is not maximized, especially in the preparation stage of learning. It is based on the observation result carried out in several schools in Klaten, Boyolali, Yogyakarta and Pontianak, so a learning devices is needed to facilitate the teachers in preparation. (4) Junior high school students do not have the independence in learning, so that teachers have difficulty in directing the students to find their own concept.

The purpose of this study are: (1) Generating a MSRL based science learning devices which is feasible to use for learning based on an expert assessment and field test, (2) Investigating the effectiveness of the developed

MSRL-based science learning devices to the SL improvement, (3) Investigating the effectiveness of the developed MSRL-based science learning devices to the GLS improvement.

The following are some terms that need to be explained in developing MSRL-based science learning to improve SL and GLS of the seventh grade of junior high school students: (1) MSRL is defined as a model of learning which trains students to have self-awareness of their potential and can use it well in learning process to achieve optimal learning outcomes consisting of analyzing, planning, implementing, comprehending,problem solving, evaluating, and modifying. Modifying phase does not appear in learning but it is the students' awareness of their own shortcomings in one meeting, so that the improvement can be felt in the next meeting. In the learning process, teachers use MSRL which serves as a facilitator and a mediator, (2) SL is the students' capacity to apply knowledge and skills, analyze, reason and communicate effectively when facing a problem, resolve and interpret problems in a variety of situations. Measurement of the students' SL in this study can be seen from the competence aspect (scientific competence) because these domains automatically also contain other domains. Literacy Indicators in this research were: (1) identify scientific issues; (2) explain scientific phenomena; (3) use scientific evidence. Increased SL can be seen from the results of students' science literacy tests before and after the learning through pretest and posttest. GLS is defined as the ability to adapt and positive habits that allow students to make effective decisions for daily demands and challenges. GLS indicators are the emergence of four domains, namely cognitive, emotional, interpersonal skills, and daily social skills; but in this research, the measurement is focused on the cognitive domain, interpersonal skills and social skills because it requires a special test to measure the emotional aspect, (3) MSRL-based science learning devices to improve SL and GLS is a science teaching devices whose application in learning is based on MSRL syntax so that it can improve the students' SL and GLS. The developed science learning devices is considered good if the prepared lesson plan, student worksheet and Authentic Assessment Instruments fulfill the validity criteria, practical and effective. On the other hand, conventional learning devices is a learning devices that is commonly used in schools by using direct instruction model. MSRL-based science learning devices is the one thing needed in teaching science with MSRL characteristics. The characteristics of the developed MSRL-based science learning devices are as follows:

a. Lesson plan

In learning, students are trained to construct their own understanding through the learning activities they experienced directly based on the MSRL syntax, which are analyze, plan, implement, comprehend, problem solving, evaluate, and modify. Teachers act as facilitators and mediators for the students in the learning activities. It is a student-centered learning.

b. Student worksheet

MSRL student worksheet was developed as a guide for the students to participate in the learning activities. The worksheet contains activities that lead students to have awareness and independence in learning. Activities in the worksheet follow the steps in MSRL syntax, which are analyze, plan, implement, comprehend, problem solving, evaluate, and modify. The activities in the worksheet emphasize on direct instruction (real) focusing on

student' self-evaluation worksheet as well as evaluation of the activities conducted.

c. Authentic Assessment Instrument (IPO)

The developed IPO consists of an assessment instrument of attitudes, knowledge and skills. MSRL-based IPO involves thinking process, analyzing, planning, implementing, comprehending, and problem solving.

2. Research Method

2.1. Procedure

This research is a Research and Development (R & D) research. Products produced in the form of MSRL-based science learning devices consisting of lesson plan, student worksheet and IPO. The development procedure used is a modification of [2] development model.The procedure of developing the science learning devices includes (1) preliminary study, (2) product design, (3) validation, (4) field testing and product revision to produce the final product. The preliminary study stage includes field surveys, curriculum analysis and literature review. The field survey was conducted through observation and interviews regarding the implementation of 2013 curriculum, especially the development of a learning devices in science subject. Curriculum analysis was done by considering things related to the development of science learning devices based on 2013 curriculum. At the stage of literature review, studies and mapping of competencies in accordance with the demands of 2013 curriculum were conducted. Science learning is expected to be delivered with real learning, scientific approach and student-centered. One model of learning that can accommodate it is MSRL.

The product design stage is the product development in the form of the preliminary draft of the MSRL-based science learning devices. The product was developed based on the 2013 curriculum. Product draft that has been developed was further validated by experts and practitioners. The expert validators were expert lecturers of science learning. The practitioners are science teachers as the potential users of the product. Validation results from the experts and practitioners serve as the basis for revising the product draft as a product revision I.

The result of revised product I was further tested for its student worksheet and IPO's readability to determine students' understanding of the sentences in the worksheet and IPO. The readability result served as a basis for revising the product leading to final product II. The final product II was then tested on a limited basis to identify the weaknesses of the product. In the limited test, same learning with the one done in field test was conducted. Weakness identified in this limited test was later revised into final product III then applied in the Field Test.

Field Test phase used two classes, the control class and the experiment class. To better know how a product affects the learning outcomes of the students, comprehensive scale trial used two classes which were control class and experiment class with nonequivalent design group control. This design is almost the same as the pretest-posttest control group. The difference is the nonequivalent design group control selects the control group and the experiment group not randomly. Factors of learning materials, learning time, and the teacher were made the same between the two classes. Control class was using the science learning devices developed by the teachers with reference to scientific approach. Experiment class was using the developed MSRL-based science learning devices. Both classes were measured in terms of their SL and GLS improvement. Extensive scale test

results mainly from the experiment class were used as a basis for evaluation and improvement of the product as product revision IV. After product III revision was conducted, the MSRL-based science learning devices became the final product.

2.2. Instruments and Data Collecting Techniques

This data was collected through interviews, observations, questionnaires, tests and documentation. Interviews were conducted in the preliminary study phase using interview guide. Observation was performed by using instruments such as observation sheet to review the processes of science learning in needs analysis, lesson plan implementation, and assessments of students' attitude during the science learning process and energy materials in the life system.

Questionnaires were distributed using the instruments' validation sheet to validate the MSRL-based science learning devices, to know the readability of MSRL-based student worksheet, and to assess students' GLS. SL and GLS measurement were conducted through instrument in the form of open ended question in the test. Furthermore, documentation was conducted to record the performance of the students during the science learning process focusing on Heat and Its Movement material in life systems using portfolio sheet instruments.

2.3. Data Analysis Technique

Data analysis techniques used to obtain the expected results can be divided into four, namely the analysis of product feasibility, analysis of lesson plan implementation, analysis of the SL and GLS improvement after the MSR-based science learning devices was implemented, as well as the analysis of the effect of the product implementation to the SL and GLS competence.

Analysis of product feasibility was analyzed qualitatively and quantitatively. Qualitative results were in the form of criticism and suggestions from the validator. For the worksheet, product feasibility was seen from the readability level by the students of class VII. Quantitative results were in the form of a score from the validator on the validation sheet. Furthermore, the scores were converted based on categorization [7] which were presented in Table 1.

Table1: Product Feasibility Categorization

Score	Accomplishment Criteria	Criteria
A	$\chi \geq \chi i + 1SBx$	Very good
B	$\chi i + 1.SBx > \chi \geq \chi i$	Good
C	$\chi i > \chi \geq \chi i - 1\ SBx$	Poor
D	$\chi < \chi i - 1.\ SBx$	Very poor

Learning devices validation result was analyzed using the following percentage agreement (Borich, 1994,

p.385).

$$percentageagreement = 1 - \frac{A-B}{B+A} x\ 100\ \%$$

The analysis of product feasibility was in the form of authentic assessment instruments, in particular was the multiple choice with reasons using Winsteps program.

Results obtained were consulted by category [8]. This analysis was used for an empirical test before and after the product was tested. This analysis reviewed the items' readability, person readability, and alpha Cronbach as the readability test. Categorization with Winsteps program was presented in **Table 2**.

Table 2: Winsteps Categorization

Person Readability* and *Item Readability		***Alpha Cronbach***	
Interval	Category	Interval	Category
< 0,67	Weak	< 0,50	Very poor
0,67 – 0,80	Sufficient	0,5 – 0,6	Poor
0,81 – 0,90	Good	0,6 – 0,7	Sufficient
0,91 – 0,94	Very good	0,7 - 0,8	Good
> 0,94	Outstanding	> 0,8	Very good

MSRL-based science lesson plan implementation was conducted by adding up the score of each component on the implementation sheet. The implementation percentage was figured out using the formula $P = \frac{\sum X}{n} x\ 100\%$ with$\sum X$ into the categorization presented in **Table 3**.

Table 3: Lesson plan Implementation Categorization

No.	Achievement criteria (%)	Category
1.	85,01 - 100,00	Very effective, could be used without revision
2.	70,01 - 85,00	Effective enough, could be used with little revision
3.	50,01 - 70,00	Less effective, could be used with major revision
4.	0,10 – 50,00	Not effective, could not be used

The analysis of SL and GLS improvement employed normalized gain score method using the formula$(g) = \frac{\%post - \%pre}{100 - \%pre}$. The normalized gain score was obtained from pretest and posttest which then was observed its improvement and was categorized based on [3] as presented in **Table 4**.

Table 4: Normalized Gain Category

Interval	Category
$\langle g \rangle \geq 0{,}7$	High
$0{,}7 > \langle g \rangle \geq 0{,}3$	Average
$\langle g \rangle < 0{,}3$	Low

The analysis of product implementation impact on SL and GLS was done using SPSS with*Independent T-Test*with requirement tests, namely normality test, homogeneity test and t-test. Further, impact analysis also observed the difference between experiment and control classes.

3. Research Finding and Discussion

The Learning Devices Product Based on MSRL was developed in accordance with 2013 curriculum on calorie and its movement for VII class. The material was appropriate to integrating MSRL in science learning. The students develop their knowledge based on stages in MSRL to understand the concepts directly and independently.MSRL basedscience learning developed fulfilled some criteria, namely: First, the lesson plan developed has some characteristics: (1) The students are trained to construct their own understanding through experiencing directly based on MSRL syntax, namely analyze, plan, implement, comprehend, problem solving, evaluate and modify; (2) Teachers function as facilitators and mediators in learning; (3) Student-centered learning. Second, the worksheet developed has some characteristics: (1) MSRL worksheet is developed as guidance to learning, (2) The worksheet consists of activities directing the students to have awareness and independence in learning, (3) The activities in the worksheet follow the steps in MSRL syntax, namely analyze, plan, implement, comprehend, problem solving, evaluate, modify,(4) The activities in the worksheetreal learning which is student centered, (5) The worksheet is equipped with self-evaluation sheet and evaluation on the activities. Third, IPOdeveloped has some characteristics: (1) IPO developed consisted of assessment instruments on attitude, knowledge and skill aspects, (2) MSRL based IPO incorporates thinking process analyze, plan, implement, comprehend, problem solving. The expert validation showed that the product was considered very appropriate to be used by experts and practitioners as seen in **Table 5.**

Table 5: Percentage of expert and practitioner validation

Assessed product	**Score Percentage**			**Average (%)**	**Category**
	Expert I	**Expert II**	**Practitioner**		
RPP	94,3	94,3	94,3	94,3	Very appropriate
LKS	80	85	90	85	Very appropriate
IPO	97,8	97,4	97,8	97,7	Very appropriate

The result of expert validation percentage agreement measurement was analyzed by using Borich equation (1994, p.385) as presented in **Table 6**.

Table 6: Expert Validation Percentage Agreement

Product	Expert Lecturer(%)	Expert Lecturer-Practitioner(%)
Lesson Plan	100,00	100,00
LKPD	96,90	96,90
IPO	99,70%	99,94%

Percentage Agreement above 70 % shows that the expert validation is very reliable.

The field testing showed that the lesson plan was implemented well with the average of implementation in each meeting 87,50 %;therefore, it could be stated that the lesson plan was implemented very well. According to [1], the score 87,50 % in the implementation showed that it was very effective and could be used without any revision. The questionnaire result of the worksheet showed that it was interesting enough as seen from the students' questionnaire on the worksheet which showed the average of 3.08. The IPO testing empirically resulted in two test packages for pretest and posttest as presented in **Table 7**.

Table 7: IPO empirical test result

Type	Item	Characteristic
Pre test	16 multiple choices	1. Measuring students' previous knowledge 2. Item reliability 0.82 (good) 3. There is nooutliers/misfit item
	3 essay	1. Measuring SL and Rational Thinking Level 2. Item reliability 0.96 (outstanding) 3. There is no outliersor misfit item
Post test	16 multiple choices	1. Measuring students' learning result 2. Item reliability 0.82 (good) 3.There is no outliers/misfit item
	3 essay	1. Measuring SL and Rational Thinking Level 2. Item Reliability 0.95 (outstanding) 3. There is no outliersor misfit item

The effectiveness of MSRL based learning devices was analyzed from the students' study result, SL improvement result, and GLS improvement result.

3.1. Study Result

A learning could be categorized as successful if there is an improvement in the students' pretest and posttest. In the field testing, the average of pretest score was 37,89, in which there was no student who met the completeness criteria. Meanwhile, the average of posttest score was 76,17 with 68,75 % students' score was above KKM. The average N-*Gain pretest*and*posttes*twas 0,63 or was in average category according to [3].

The learning devices developed was based on 2013 curriculum, so it also measures the achievement of KI-KI4. **Table 8**. presents the average of the students' study result during the field testing.

Table 8: Students' Study Result

Study Result	Score	KKM
KI 1	3,49 (B+)	B
KI 2	3,14 (B)	B
KI 3	3,05 (B)	B
KI 4	3,31(B+)	B

KI study result showed a satisfying achievement that is on average the students have met KKM, that is B.

3.2. Students' SL Result

The measurement of the students' SL showed that improvement (gain) 0.64 was categorized into average criteria [3]. The improvement was showed on the average of pretest score 20.00 and posttest score 71,07. The summary of SL analysis is presented in **Table 9**.

Table 9: Students' SL Result

Criteria	***Pre Test***	***Post Test***	***Gain***	***N-Gain***
Min	2,08	26,92	24,84	0,25
Max	37,50	98,08	60,58	0,97
Average	20,20	71,07	50,87	0,64
SD	11,38	23,17	11,78	0,13

3.3. GLS Result

There were three aspects used to measure the students: (1) Rational thinking proficiency, which covers finding information, analyzing information, making decision and problem solving. The result of rational thinking proficiency analysis is presented in **Table 10**.

Table 10: Rational Thinking Proficiency

Rational thinking proficiency	**Average*Pretest***	**Average*Posttest***	***N-Gain***
Finding information	0,7	2,8	0,6
Analyzing information	0,5	2,5	0,6
Making decision	0,7	1,9	0,4
Problem solving	0,7	1,7	0,3

Table 10. showed that the students' rational thinking proficiency with maximum score of 4 was in average category but it was not high enough in solving problem proficiency. The scores of pretest and posttest in problem solving were the lowest if compared to other proficiencies. The pretest and posttest gain showed that the students' proficiencies fell into average category [3]. (2) Personal Proficiency and Social Proficiency, the result of pretest and posttest showed that the score for pretest was 72.0 and 85.0 for posttest. The improvement gain was 0.47, in was categorized as average [3].

Effectiveness Testing

The effectiveness testing was done by comparing two classes, control and experiment classes. The chosen control class was 7C class SMPN 1 Banyudono and the experiment class was 7A class at the same school. The subjects in each class were 31 students. In the experiment class, MSRL based learning devices was employed and the control class used the learning devices available at school. The assessment in the control group was done on attitude aspect, that was social attitude that was based on the teacher's memory and knowledge aspect which was written in 5 items essay test. Meanwhile, in the experiment group, the assessment was using authentic assessment with three aspects, namely spiritual and social aspect, skill aspect and knowledge aspect.

Table 11. is the summary of the gain improvement in control and experiment classes. **Table 11.** showed that there was difference in SL and GLS capabilities between control and experiment classes. This showed that MSRL was more effective in improving the students' SL and GLS capabilities compared with the conventional model implemented in the school.

The result of Independent T-Test Sample showed that MSRL based learning devices could improve SL and GLS significantly. The normality test on control and experiment classes showed Kolmogorov-smirnov Z andsignificance*asymp.Sig.* (2 tailed) $\geq$ 0.05 so the data was distributed normally that was 0,057 and 0.140. The variants homogeneity test (*Levene's Test for Equality of Variances*) showed the significance value of F $\geq$ 0,05 so both groups were homogeny. The T-test showed that t value 2,031 with sig (2-tailed) 0.048 for SL; this showed

that the average difference of SL capability was significant and for GLS, the t value was 2.412 with sig(2-tailed) 0.02; this showed that there was a difference in the personal and social capabilities of the students in VIIA and VIIC classes with sig(2-tailed) <0.05.

Table 11: The comparison of *N-Gain Pretest Posttest*Control and Experiment classes

Improvement		**Control class**	**Experiment class**
SL		0,57	0,614
GLS (Rational thinking skills)			
a.	Finding information skill	0,67	0,75
b.	Analyzing information skill	0,49	0,65
c.	Making decision skill	0,33	0,56
d.	Solving problem skill	0,25	0,57
e.	Personal skill and social skill	0,42	0,47

4. Conclusion

Based on the developmental research conducted starting from developing the prototype to the final product, it was concluded that 1) MSRL based science learning devices which consisted of lesson plan, student worksheet, and authentic assessment instrument was appropriate to be used in science learning for junior high school class VII based on 2013 curriculum and satisfied the needs of the 21st century learning, 2) The students' SL capability showed that MSRL based science learning devices which consisted of lesson plan, student worksheet and authentic assessment instrument was effective to improve the students' SL as seen in N-Gain and *Independent T-Test Samples*, 3) The result of the students' GLS capability showed that MSRL based science learning devices which consisted of lesson plan, student worksheet, and authentic assessment instrument brought about effective improvement as seen in N-Gain and *Independent T-Test Samples*.

5. Suggestion

The result of this research and development could be used in the effort of implementing developed products, namely: (1) MSRL based science learning devices is recommended to be used by schools or teachers continuously and to be developed in accordance with the condition and needs of the school on other materials since promoting the students' GLS needs to be done early and continuously so that the students could be improved in the 21st century; (2) MSRL based science learning devices on calorie and its movement theme for VII class of junior high school could be used optimally to improve the students' SL and GLS.

References

[1] Akbar, S. (2013). Instrumen perangkat pembelajaran (Instrument of learning tools). Bandung: RemajaRosdakarya, 2013.

[2] Borg, W. R., & Gall, M. D. Educational research(4 ed.). New York: Logman Inc.1983.

[3] Hake, R.R. Interactive-engagement versus traditional methods : A six-thousand-student survey of mechanics test data for introductory physics courses. Am. J. Phys. 66(1),pp. 64-74, 1998.

[4] Kemendikbud. Lampiran peraturan menteri pendidikan dan kebudayaan republik Indonesia nomor 68 tahun 2013 tentang kerangka dasar dan struktur kurikulum sekolah menengah pertama/madrasah tsanawiyah (Appendix of Minister of Education and Culture of the Republic of Indonesia no. 68 of 2013 on the basic framework and structure of junior high school curriculum / madrasah tsanawiyah). Jakarta: Kemendikbud, 2013.

[5] OECD. (2012). Database, Table III.3.1a.12., 2012.

[6] OECD. PISA 2012 Results: What students know and can do – student performance in mathematics, reading and science (Volume I), PISA, OECD Publishing. 2013.

[7] Mardapi, D. Teknik Penyusun Instrumen Tes dan Non Tes (Technique of Preparation of Test and Non Test Instruments.). Yogyakarta :Mitra Cendekia Press, 2008

[8] Sumintono, B. &Widhiarso, W.Aplikasi model rasch untuk penelitian ilmu-ilmusosial (Application of rasch model for social sciences research). Cimahi: TrimKom Publishing House, 2013.