

# Table of contents

Volume 947

**2018**

◀ Previous issue    Next issue ▶

**Mathematics, Informatics, Science and Education International Conference (MISEIC) 9  
September 2017, Surabaya, Indonesia**

Accepted papers received: 18 December 2017

Published online: 10 January 2018

Open all abstracts

---

## Preface

---

**OPEN ACCESS** 011001

Mathematics, Informatics, Science and Education International Conference (MISEIC)

+ Open abstract     View article     PDF

---

**OPEN ACCESS** 011002

Peer review statement

+ Open abstract     View article     PDF

---

## Papers

---

**OPEN ACCESS** 012001

The Effect of Sodium Hydroxide Molarity on Strength Development of Non-Cement  
Class C Fly Ash Geopolymer Mortar

A Wardhono



+ Open abstract     View article     PDF

---

**OPEN ACCESS** 012002

Kinetic Parameters of Thermal Decomposition Process Analyzed using a Mathematical  
Model

A B D Nandiyanto, R Ekawati and S C Wibawa

+ Open abstract     View article     PDF

This site uses cookies. By continuing to use this site, you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



---

**OPEN ACCESS**

012003

**The Classification of Diabetes Mellitus Using Kernel k-means**

M Alamsyah, Z Nafisah, E Prayitno, A M Afida and E M Imah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012004

**Iris Recognition Using Feature Extraction of Box Counting Fractal Dimension**

C Khotimah and D Juniati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012005

**Gaussian Process Regression Model in Spatial Logistic Regression**

A Sofro and A Oktaviana

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012006

**Some Basic Properties of Uniformly Symmetrically Continuous (Real Valued) Functions on Metric Spaces**

Manuharawati, D N Yunianti and M Jakfar

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012007

**Student's Critical Thinking in Solving Open-Ended Problems Based on Their Personality Type**

L D Fitriana, Y Fuad and R Ekawati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012008

**Designing Tasks to Examine Mathematical Knowledge for Teaching Statistics for Primary Teachers**

T Y E Siswono, A W Kohar and S Hartono

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012009

**The improvement of autism spectrum disorders on children communication ability with PECS method Multimedia Augmented Reality-Based**

Taryadi and I Kurniawan

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012010

The Role of Self-Assessment in Foundation of Mathematics Learning

Masriyah

+ Open abstract  View article  PDF

---

**OPEN ACCESS** 012011

Multiple Sensing Application on Wireless Sensor Network Simulation using NS3

I F Kurniawan and R Bisma

+ Open abstract  View article  PDF

---

**OPEN ACCESS** 012012

Students' Creativity: Problem Posing in Structured Situation

I K Amalina, M Amirudin and M T Budiarto

+ Open abstract  View article  PDF

---

**OPEN ACCESS** 012013

Critical-Inquiry-Based-Learning: Model of Learning to Promote Critical Thinking Ability of Pre-service Teachers

S Prayogi, L Yuanita and Wasis

+ Open abstract  View article  PDF

---

**OPEN ACCESS** 012014

Students' Spatial Performance: Cognitive Style and Sex Differences

U Hanifah, D Juniati and T Y E Siswono

+ Open abstract  View article  PDF

---

**OPEN ACCESS** 012015

Designing PISA-Like Mathematics Tasks In Indonesia: Experiences and Challenges

Z Zulkardi and A W Kohar

+ Open abstract  View article  PDF

---

**OPEN ACCESS** 012016

High-Impact Aerobic and Zumba Fitness on Increasing VO<sub>2</sub>MAX, Heart Rate Recovery and Skinfold Thickness

T J Suminar, N W Kusnanik and O Wiriawan

+ Open abstract  View article  PDF

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see

[our privacy and Cookies policy.](#)

012017 

## Students' Covariational Reasoning in Solving Integrals' Problems

N V Harini, Y Fuad and R Ekawati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012018

## Students' Misconceptions on Properties of Rectangles

R W Ningrum, M Yulianti, D D Z Helingo and M T Budiarto

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012019

## Mathematics Literacy of Secondary Students in Solving Simultaneous Linear Equations

R S I Sitompul, I K Budayasa and Masriyah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012020

## Teacher's Mathematical Communication Profile in Facilitating and Guiding Discussion

R Umami, I K Budayasa and St Suwarsono

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012021

## Improving Science Process Skills for Primary School Students Through 5E Instructional Model-Based Learning

N L Choirunnisa, P Prabowo and S Suryanti

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012022

## Refractive Thinking Profile In Solving Mathematical Problem Reviewed from Students Math Capability

M Maslukha, A Lukito and R Ekawati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012023

## The Creativity of Reflective and Impulsive Selected Students in Solving Geometric Problems

R N Shoimah, A Lukito and T Y E Siswono

[+ Open abstract](#) [View article](#) [PDF](#)

---

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see

[our privacy and cookies policy.](#)

012024 

## The Physiological Profile of Junior Soccer Players at SSBB Surabaya Bhakti

M Nashirudin and N W Kusnanik

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012025

## Flexibility in Mathematics Problem Solving Based on Adversity Quotient

N A Dina, S M Amin and Masriyah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012026

## Process Skill Assessment Instrument: Innovation to measure student's learning result holistically

K N Azizah, M Ibrahim and W Widodo

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012027

## Laboratory Activity Worksheet to Train High Order Thinking Skill of Student on Surface Chemistry Lecture

B Yonata and H Nasrudin

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012028

## Student Teachers' Proof Schemes on Proof Tasks Involving Inequality: Deductive or Inductive?

A H Rosyidi and A W Kohar

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012029

## The Implementation of Cumulative Learning Theory in Calculating Triangular Prism and Tube Volumes

M Muklis, C Abidin, M D Pamungkas and Masriyah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012030

## Students' Relational Thinking of Impulsive and Reflective in Solving Mathematical Problem

M A Satriawan, M T Budiarto and T Y E Siswono

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012031

**Creativity of Field-dependent and Field-independent Students in Posing Mathematical Problems**

N Azlina, S M Amin and A Lukito

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012032

**The Use of Open-Ended Questions with Giving Feedback (OEQGF) for Effective Mathematic Learning**

I Sabilah and J T Manoy

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012033

**The Effectiveness of Guided Inquiry Learning for Comparison Topics**

Asnidar, S Khabibah and R Sulaiman

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012034

**The Development of Inquiry Learning Materials to Complete Content Life System Organization in Junior High School Students**

F Mayasari, Raharjo and Z A I Supardi

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012035

**Slow Learner Errors Analysis in Solving Fractions Problems in Inclusive Junior High School Class**

N Novitasari, A Lukito and R Ekawati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012036

**Statistical Literacy: High School Students in Reading, Interpreting and Presenting Data**

M Hafiyusholeh, K Budayasa and T Y E Siswono

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012037

**Problem Solving-based Learning Materials on Fraction for Training Creativity of Elementary School Students**

This website has cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012038

### Representation of Students in Solving Simultaneous Linear Equation Problems Based on Multiple Intelligence

Y R Yanti, S M Amin and R Sulaiman

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012039

### Students' Relational Understanding in Quadrilateral Problem Solving Based on Adversity Quotient

A N Safitri, D Juniati and Masriyah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012040

### The Effect of Acceleration Sprint and Zig-zag Drill Combination to Increase Students' Speed and Agility

O Bana, E Mintarto and N W Kusnanik

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012041

### Junior high school students' reflective thinking on fraction problem solving: In case of gender differences

M A Rasyid, M T Budiarto and A Lukito

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012042

### The Ability of Students' Mathematical Proof in Determining the Validity of Argument Reviewed from Gender Differences

Feriyanto

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012043

### Effect of Exercise Program Speed, Agility, and Quickness (SAQ) in Improving Speed, Agility, and Acceleration

K Azmi and N W Kusnanik

[+ Open abstract](#) [View article](#) [PDF](#)

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see [our Privacy and Cookies policy.](#)



**OPEN ACCESS**

Students' Algebraic Reasoning In Solving Mathematical Problems With Adversity Quotient 012044

F Aryani, S M Amin and R Sulaiman

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012045

Effects of High Intensity Interval Training on Increasing Explosive Power, Speed, and Agility

F Fajrin, N W Kusnanik and Wijono

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012046

Guided Inquiry with Cognitive Conflict Strategy: Drilling Indonesian High School Students' Creative Thinking Skills

A F Syadzili, Soetjipto and Tukiran

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012047

The Development of Student's Activity Sheets (SAS) Based on Multiple Intelligences and Problem-Solving Skills Using Simple Science Tools

D S Wardani, T Kirana and M Ibrahim

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012048

Functional Thinking Profile of Junior High School Student in Solving Mathematical Problem Observed by Differences of Sex

A P Siregar, D Juniati and R Sulaiman

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012049

The Effectiveness of Guided Inquiry-based Learning Material on Students' Science Literacy Skills

E V Aulia, S Poedjiastoeti and R Agustini

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS** 012050

The Elementary School Students' Mathematical Problem Solving Based on Reading Abilities

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see

[RUD Wulandari, A Lukman, S Khabibah](#)



[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012051

Algebraic Thinking in Solving Linear Program at High School Level: Female Student's Field Independent Cognitive Style

N Hardiani, I K Budayasa and D Juniati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012052

Effectiveness of Cooperative Learning Instructional Tools With Predict-Observe-Explain Strategy on the Topic of Cuboid and Cube Volume

Nurhuda, A Lukito and Masriyah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012053

Error Analysis of Indonesian Junior High School Student in Solving Space and Shape Content PISA Problem Using Newman Procedure

U Sumule, S M Amin and Y Fuad

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012054

Developing Media Module Proposed to Editor in Editorial Division

A Kristanto, Mustaji, A Mariono, Sulistiowati and D W Nuryati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012055

The blind student's interpretation of two-dimensional shapes in geometry

Andriyani, I K Budayasa and D Juniati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012056

The Clinical Test of Nano gold Cosmetic for Recovering Skin Damage Due to Chemicals: Special Case

T Taufikurohmah, A P Wardana, S Tjahjani, I G M Sanjaya, A Baktir and A Syahrani

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012057

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



Profile of Metacognition of Mathematics Pre-Service Teachers in Understanding the Concept of Integral Calculus with Regard Gender Differences

L Misu, I K Budayasa and A Lukito

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012058

Understanding fraction concepts of Indonesian junior high school students: A case of field independent and field dependent students

K Mamonto, D Juniati and T Y E Siswono

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012059

Students' Representation in Mathematical Word Problem-Solving: Exploring Students' Self-efficacy

A Sahendra, M T Budiarto and Y Fuad

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012060

Students' Self-Monitoring on Mathematics Ability: Cube and Cuboid Problem Solving

N T Lusiana, A Lukito and S Khabibah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012061

Algebraic Reasoning in Solving Mathematical Problem Based on Learning Style

N F Indraswari, I K Budayasa and R Ekawati

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012062

Development of Problem-Based Learning Oriented Teaching Learning Materials to Facilitate Students' Mastery of Concept and Critical Thinking Skill

M Reza, M Ibrahim and Y S Rahayu

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012063

Training of Students' Critical Thinking Skills through the implementation of a Modified Free Inquiry Model

S A Hadi, E Susantini and R Agustini

[+ Open abstract](#) [View article](#) [PDF](#)

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see [our Privacy and Cookies policy.](#)

012064

## The Profile of Student Misconceptions on The Human and Plant Transport Systems

M Ainiyah, M Ibrahim and M T Hidayat

[+ Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS**

012065

## Spatial Skill Profile of Mathematics Pre-Service Teachers

R O E Putri

[+ Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS**

012066

## A Metacognitive Profile of Vocational High School Student's Field Independent in Mathematical Problem Solving

L Nugraheni, I K Budayasa and S T Suwarsono

[+ Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS**

012067

## Developing Learning Model P3E to Improve Students' Critical Thinking Skills of Islamic Senior High School

Bahtiar, Y S Rahayu and Wasis

[+ Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS**

012068

## Students' Thinking Processes on Quadrilateral Concept: A Case of Providing Non-Examples

E B Rahaju

[+ Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS**

012069

## Technological Pedagogical Content Knowledge of Prospective Mathematics Teacher in Three Dimensional Material Based on Sex Differences

M A Aqib, M T Budiarto and P Wijayanti

[+ Open abstract](#) [View article](#) [PDF](#)

**OPEN ACCESS**

012070

## The written mathematical communication profile of prospective math teacher in mathematical proving

K V Pantaleon, D Juniati, A Lukito and K Mandur

[+ Open abstract](#) [View article](#) [PDF](#)  
 This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



---

**OPEN ACCESS**

012071

**Drilling Students' Communication Skill through Science, Environment, Technology, and Society (SETS)-Based Learning**

B L Al-Farisi, Tjandrakirana and R Agustini

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012072

**Students' metacognitive activities in solving the combinatorics problem: the experience of students with holist-serialist cognitive style**

B N Trisna, I K Budayasa and T Y E Siswono

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012073

**Critical Thinking Skills of an Eighth Grade Male Student with High Mathematical Ability in Solving Problem**

Ismail

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012074

**Quadcopter Path Following Control Design Using Output Feedback with Command Generator Tracker LOS Based At Square Path**

A T Nugraha and T Agustinah

[+ Open abstract](#) [View article](#) [PDF](#)

---

**OPEN ACCESS**

012075

**Introducing Nine-Point Circle to Junior High School Students**

S Fiangga, M A N Azizah, R N K Rini and A N Hidayanti

[+ Open abstract](#) [View article](#) [PDF](#)

---

**JOURNAL LINKS**

---

[Journal home](#)

---

[Journal Scope](#)

---

[Information for organizers](#)

---

[Information for authors](#)

---

[Contact us](#)

---

Reprint services from Curran Associates

This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our [Privacy and Cookies policy](#).



This site uses cookies. By continuing to use this site you agree to our use of cookies. To find out more, see our Privacy and Cookies policy.



PAPER • OPEN ACCESS

# The Effectiveness of Guided Inquiry-based Learning Material on Students' Science Literacy Skills

To cite this article: E V Aulia *et al* 2018 *J. Phys.: Conf. Ser.* **947** 012049

View the [article online](#) for updates and enhancements.

## Recent citations

- [Developing chemical equilibrium practicum module based on guided inquiry to explore students' abilities in designing experiments](#)  
F D N Pamenang *et al*



**ECS** **240th ECS Meeting**  
Digital Meeting, Oct 10-14, 2021

**Register early and save up to 20% on registration costs**

Early registration deadline Sep 13

**REGISTER NOW**

# The Effectiveness of Guided Inquiry-based Learning Material on Students' Science Literacy Skills

E V Aulia<sup>1</sup>, S Poedjiastoeti<sup>1,\*</sup>, R Agustini<sup>1</sup>

<sup>1</sup> Science Education, Post Graduate Program, Universitas Negeri Surabaya, Jl. Ketintang 30 Surabaya 60231, Indonesia

\* Email: sripoedjiastoeti@unesa.ac.id

**Abstract.** The purpose of this research is to describe the effectiveness of guided inquiry-based learning material to improve students' science literacy skills on solubility and solubility product concepts. This study used Research and Development (R&D) design and was implemented to the 11<sup>th</sup> graders of Muhammadiyah 4 Senior High School Surabaya in 2016/2017 academic year with one group pre-test and post-test design. The data collection techniques used were validation, observation, test, and questionnaire. The results of this research showed that the students' science literacy skills are different after implementation of guided inquiry-based learning material. The guided inquiry-based learning material is effective to improve students' science literacy skills on solubility and solubility product concepts by getting N-gain score with medium and high category. This improvement caused by the developed learning material such as lesson plan, student worksheet, and science literacy skill tests were categorized as valid and very valid. In addition, each of the learning phases in lesson plan has been well implemented. Therefore, it can be concluded that the guided inquiry-based learning material are effective to improve students' science literacy skills on solubility and solubility product concepts in senior high school.

## 1. Introduction

Science literacy skills is the ability to engage with science-related issues, scientific ideas, and the capability of becoming a reflective thinking person [1]. The PISA 2015 report reveals that a person who is literate in science must have the competence to explain phenomena, evaluate and design investigations, and interpret data and evidence scientifically. There are four aspects of science literacy skills which are interrelated each other according to PISA 2015, including context, knowledge, competence, and attitudes [1]. Science literacy skills can be trained in chemistry learning because it provides a direct learning experience to the students through the use and development of process skills and scientific attitudes to solve problems in everyday life [2]. Based on the characteristics of chemistry lesson, the suitable method used to develop students' thinking ability and improve students' science literacy skills is guided inquiry learning model. Guided inquiry learning is a scientific process of active exploration that uses critical, logical, and creative thinking skills to answer questions by teacher guidance [3].

Various results of researches showed that the implementation of guided inquiry model which integrated with guided inquiry-based learning material in chemistry lesson is effective and efficient to get learning outcomes with the best quality. Activity and student achievement on solubility and solubility product can be increased if the applied guided inquiry model is equipped with student worksheet [4]. Generally, the students are better to learn through the use of guided inquiry-based



learning with laboratory experimental method. Through the guided inquiry learning, significant improvements occur in all aspects of students' attitudes and academic achievements. In addition, there was a significant decrease on students' anxiety in chemical laboratories [5]. In inquiry-based laboratory activities, the students have fewer misconceptions and understand concepts much more meaningfully. The average score of students' performance were also increasing significantly. The students believed that chemical knowledge helps to interpret the phenomenon in everyday life and has an important role in modern life [6]. In addition, implementation of science literacy skills based on inquiry learning in laboratory activities can improve the science literacy skills of high school students in terms of content, context, process and attitudes aspects. Therefore, it can be concluded that guided inquiry learning model can make students more confident and make the learning process more meaningful [7].

The average score of students' conceptual understanding using guided inquiry model is greater than traditional teaching. The guided inquiry learning model is effective to build conceptual relationships and rectifying misconceptions [8]. The students' achievement increases at nominal, functional, and conceptual levels of chemical literacy through the inquiry learning. The highest increase is achieved by conceptual aspect of chemical literacy, that is understanding the relationship between concepts and main ideas [9]. However, the researches did not discuss about learning material which compatible with guided inquiry learning to improve students' science literacy skills and learning outcomes of science literacy on the content, context, processes and attitudes aspects are not discussed in detail. In addition, the science literacy skills on attitude aspect are not discussed and only focus on cognitive aspect. Therefore, this research would develop guided inquiry-based learning material and implemented it in order to improve students' science literacy skills in terms of context, competence, attitude, and knowledge aspects on solubility and solubility product ( $K_{sp}$ ) concepts.

The results of preliminary study done to the 11<sup>th</sup> graders of Muhammadiyah 4 Senior High School Surabaya showed that students still lacked of science literacy skills. Based on test of science literacy skills in context, competence and knowledge aspects, the students have not been able to answer the problem well and correctly. There was 92% of the students who could not propose an exact problem formulation in accordance with phenomenon, 84% of the students who could not formulate hypothesis, and 92% of students who could not determine the variables correctly. A lot of students could not answer the questions based on observation table correctly and determine conclusions appropriately. It is because the learning methods used by the teacher during this time always use lecturing method or conventional learning model. It can be seen from the result of student questionnaire that 80% of them agree with the statement above.

Based on questionnaire and interview with chemistry teacher showed that learning material (worksheet) contained questions without experimental activities. A lot of students thought that the summary of the material in the worksheet is not interesting and the language is difficult to understand. The worksheet is not made by the teacher but from the publisher, so it is general and not in accordance with characteristics of students in that school. Based on the description above, the researcher develops a chemistry learning material that are able to fulfill the criteria of validity, practicality, and effectiveness. Generally, the purpose of this research is to describe the effectiveness of guided inquiry-based learning material to improve students' science literacy skills on solubility and solubility product ( $K_{sp}$ ) concepts.

## 2. Method

The research subjects of the implementation of guided inquiry-based learning material on solubility and solubility product concepts are 20 students who are 11<sup>th</sup> graders of Muhammadiyah 4 Senior High School Surabaya in 2016/2017 academic year. The development of learning material uses Research and Development (R&D) design [10]. The developed learning material in this research consists of lesson plan, student worksheet, and science literacy skills tests. The stages in research and development method include preliminary study, model development, and testing [10]. However, this research is limited to the stage of model development. The learning material that is implemented in this research have passed the validity test stage with valid and very valid category.

This research was conducted in 5 weeks starting from April to May 2017 by employing a pre-experimental research, that is one group pre-test and post-test design [11]. Experimental design was used to investigate the effectiveness of guided inquiry-based learning material. The data to seek for the effectiveness was obtained through students' science literacy skills test scores in terms of context, competence, and knowledge aspects (assessment sheet 1) and attitude aspects (assessment sheet 2). Then, the data that were obtained was analyzed descriptively. The scores of students' science literacy skills are categorized based on the following criteria: very less, less, enough, good, and very good [12][13]. The differences in students' science literacy skills scores before and after the treatment were analyzed using N-gain. The N-gain calculation data were then converted using the criteria that presented in Table 1.

$$\text{Normalized gain } (g) = \frac{\text{Post - test score} - \text{Pre - test score}}{\text{Maximum score} - \text{Pre - test score}}$$

**Table 1.** Criteria N-gain score was adopted from reference [14]

Score N-gain	Criteria
$0.7 < \text{N-gain}$	High
$0.3 \leq \text{N-gain} \leq 0.7$	Medium
$\text{N-gain} < 0.3$	Low

### 3. Results and Discussion

#### 3.1. Scores of students' science literacy skills in terms of context, competence, and knowledge aspects

Students' science literacy skills were measured using a test instrument consisting of 20 multiple-choice questions and 5 essay questions (assessment sheet 1). Table 2 shows the scores of students' science literacy skills and the increase of N-gain score.

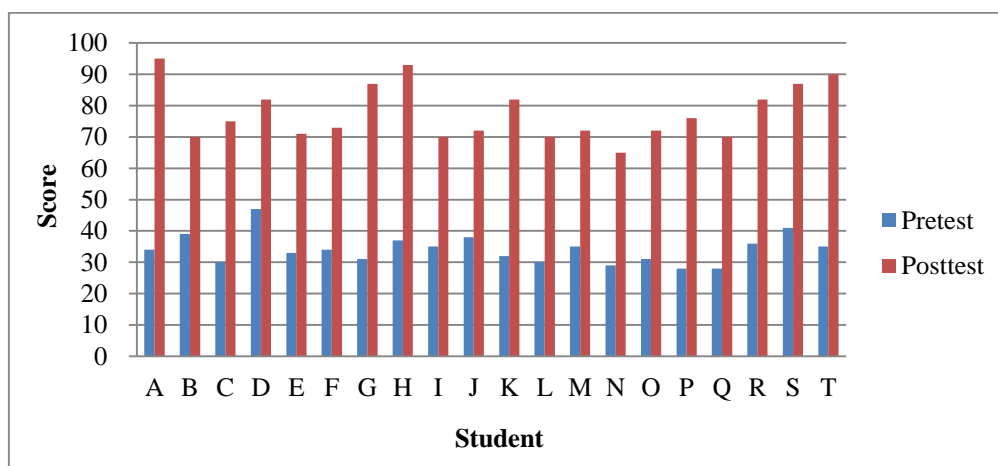
**Table 2.** Results of N-gain analysis of students' science literacy skills in context, competence, and knowledge aspects

Student	Pre-test		Post-test		N-gain	Category
	Score	Category	Score	Category		
A	34	Less	95	Very good	0.92	High
B	39	Less	70	Good	0.51	Medium
C	30	Less	75	Good	0.64	Medium
D	47	Enough	82	Very good	0.66	Medium
E	33	Less	71	Good	0.57	Medium
F	34	Less	73	Good	0.59	Medium
G	31	Less	87	Very good	0.81	High
H	37	Less	93	Very good	0.89	High
I	35	Less	70	Good	0.54	Medium
J	38	Less	72	Good	0.55	Medium
K	32	Less	82	Very good	0.74	High
L	30	Less	70	Good	0.57	Medium
M	35	Less	72	Good	0.57	Medium
N	29	Less	65	Good	0.51	Medium
O	31	Less	72	Good	0.59	Medium
P	28	Less	76	Good	0.67	Medium
Q	28	Less	70	Good	0.58	Medium
R	36	Less	82	Very good	0.72	High
S	41	Enough	87	Very good	0.78	High
T	35	Less	90	Very good	0.85	High

Data in Table 2 showed that students' science literacy skills scores of context, competence, and knowledge aspects at pre-test ranged from 28 to 47, in which 18 students got scores with less category

and 2 students got scores with enough category. After implementing guided inquiry learning using learning material that was developed and conducted post-test, the students' science literacy skills scores ranged from 65 to 95, in which 12 students got scores with good category and 8 students got scores with very good category. The students' science literacy skills are significantly increasing which is stated by N-gain score. There are 7 students (35%) got N-gain score in high category, and 13 students (65%) got N-gain score in medium category. The high increase in N-gain score showed that implementation of developed learning material through guided inquiry learning can improve students' science literacy skills. The increase of N-gain score occurs because the teacher who has been performing all phases of guided inquiry learning implemented in well to excellent category. In addition, the learning steps in the lesson plan were developed in accordance with the syntax of inquiry learning model which includes six phases focusing on the activities, explaining inquiry process, presenting inquiry problem, formulating hypotheses, collecting data, formulating conclusion, and reflecting problems and developing thinking process [15].

Inquiry-based learning is effectively guided to improve students' science literacy skills due to the students' learning stages according to Piaget's cognitive development including the formal operational stage – a stage in which students can already think abstractly or symbolically and solve problems through doing experiment [16]. Visually, the difference between the pre-test and post-test scores of students' science literacy skills is presented in Figure 1.



**Figure 1.** Diagram of pre-test and post-test scores of students' science literacy skills in terms of context, competence, and knowledge aspects

### 3.2. Scores of students' science literacy skills in attitude aspect

Students' science literacy skills were measured using a questionnaire instrument consisting of 30 positive and negative statements. Those statements include 4 indicators of attitudes: students' attitudes toward science, the importance of science in life, students' responses to science as a career, and students' responses to science learning in schools (assessment sheet 2). The assessment sheet 2 consists of two types of assessment: self assessment and peer assessment. The scores of students' science literacy skills and the increase of N-gain score are presented in Table 3.

**Table 3.** Results of N-gain analysis of students' science literacy skills in attitude aspect

Student	Pre-test		Post-test		N-gain	Category
	Score	Category	Score	Category		
A	2.29	Enough	3.67	Very good	0.81	High
B	2.05	Enough	3.46	Good	0.72	High
C	2.37	Enough	3.60	Very good	0.75	High
D	2.63	Good	3.60	Very good	0.71	High

Student	Pre-test		Post-test		N-gain	Category
	Score	Category	Score	Category		
E	2.44	Enough	3.61	Very good	0.75	High
F	2.60	Good	3.60	Very good	0.71	High
G	2.94	Good	3.95	Very good	0.95	High
H	2.36	Enough	3.62	Very good	0.77	High
I	2.96	Good	3.67	Very good	0.68	Medium
J	2.34	Enough	3.56	Very good	0.73	High
K	2.56	Good	3.57	Very good	0.70	High
L	2.73	Good	3.50	Good	0.61	Medium
M	2.49	Enough	3.73	Very good	0.82	High
N	2.54	Good	3.64	Very good	0.75	High
O	2.39	Enough	3.26	Good	0.54	Medium
P	2.78	Good	3.70	Very good	0.75	High
Q	2.67	Good	3.66	Very good	0.74	High
R	2.56	Good	3.45	Good	0.62	Medium
S	2.57	Good	3.32	Good	0.52	Medium
T	2.03	Enough	2.97	Good	0.48	Medium

Data in Table 3 showed that the average score of students' science literacy skills in all aspects of attitude at pre-test reach the range 2.03 to 2.96 with enough to good category. After the implementation of guided inquiry learning and post-test implementation, the average score of students' attitudes reach the range 2.97 to 3.95 with good to very good category. The average score of attitude aspect is derived from self-assessment and peer-assessment because self-assessment has a weakness in terms of the validity of the answer. The existence of elements of the preferred properties and concepts that are considered good by the society cause the answer given is not necessarily in line with the facts practiced everyday [17]. These data indicated that there is an increase in the score between pre-test and post-test in every aspect of attitude. It means that guided inquiry-based learning material on solubility and solubility product ( $K_{sp}$ ) concepts can improve the students' science literacy skills in all aspects of attitudes.

A total of 14 students (70%) got N-gain score in high category, and 6 students (30%) got N-gain score in medium category. The high improvement in N-gain score showed that implementation of developed learning material through guided inquiry learning can improve students' science literacy skills. The improvement of N-gain score is because teacher has been performing all phases of guided inquiry learning in well to excellent category. In addition, the improvement of the average score on all the indicators of attitude is because the students have been trained to use the scientific attitude through guided inquiry-based learning activities conducted during the three meetings, such as discussing with a group of friends in identifying and formulating problem based on the given phenomenon, preparing hypothesis, determining experimental variables, experimenting, writing experimental data, analyzing experimental results, and formulating conclusions. In guided inquiry, there is a scientific process that employs critical, logical, and creative thinking skills to answer questions posed with scientific attitudes [3].

This results are supported by Ural who states that there is a significant increase in all aspects of students' academic attitudes and achievements through the use of guided inquiry-based laboratory experimental method. In guided inquiry, the students are more confident and the experiment becomes more meaningful [5]. It is also supported by Setowati's research which states that activities and students' achievement on  $K_{sp}$  material that include aspects of knowledge, attitude, and skills improve. The assessments of spiritual attitudes, cooperation, honestly, discipline, and responsibility increase and those assessments are classified into very good category [4].

#### 4. Conclusion

Based on the results and discussion of this research, it can be concluded that the developed guided inquiry-based learning material is effective to be used in teaching and learning in order to improve students' science literacy skills on solubility and solubility product ( $K_{sp}$ ) concepts. This is proven by the increase of N-gain score with medium and high category both on science literacy skills in aspects of context, competence and knowledge, as well as in aspects of attitude. Thus, there is a positive effect between the development of guided inquiry-based learning material and the improvement of various aspects of science literacy skills for senior high school students. Moreover, it is suggested that further researchers can develop similar learning material for other subjects or materials to train students' science literacy skills, experimental skills, as well as to apply chemistry concepts in everyday life. In addition, teachers should prepare various sources of literature, master learning steps, and manage the class well so that guided inquiry-based learning will be more effective in improving students' science literacy skills.

#### Acknowledgments

The author would like to thank Dr. Utiya Azizah M.Pd., Dr. Harun Nasrudin, M.Pd., and Drs. Agus Subroto, M.Pd. as the validators of the developed learning material. The author also thanks the headmaster and chemistry teacher of Muhammadiyah 4 Senior High School Surabaya who have allowed and assisted this research.

#### References

- [1] OECD 2016 *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy* (Paris: OECD Publishing)
- [2] Mulyasa 2013 *Menjadi Guru Profesional: Menciptakan Pembelajaran Kreatif dan Menyenangkan* (Bandung: PT Remaja Rosdakarya)
- [3] Llewellyn D 2005 *Teaching High School Science Through Inquiry* (Amerika: Corwin Press)
- [4] Setiowati H, Nugroho A, and Agustina W 2015 Penerapan Model Pembelajaran Inkuiri Terbimbing (Guided Inquiry) Dilengkapi LKS untuk Meningkatkan Aktivitas dan Prestasi Belajar Siswa pada Materi Pokok Kelarutan dan Hasil Kali Kelarutan Kelas XI MIA SMA Negeri 1 Banyudono Tahun Pelajaran 2014/2015 *Jurnal Pendidikan Kimia (JPK)* **4** pp 54-60
- [5] Ural E 2016 The Effect of Guided-Inquiry Laboratory Experiments on Science Education Students' Chemistry Laboratory Attitudes, Anxiety and Achievement *Journal of Education and Training Studies* **4** pp 217-227
- [6] Sesen B A and Tarhan L 2013 Inquiry-Based Laboratory Activities in Electrochemistry: High School Students' Achievements and Attitudes *Research in Science Education* **43** pp 413-435
- [7] Rakhmawan A, Setiabudi A, and Mudzakir A 2015 Perancangan Pembelajaran Literasi Sains Berbasis Inkuiri pada Kegiatan Laboratorium *Jurnal Penelitian dan Pembelajaran IPA (JPPI)* **1** pp 143-152
- [8] Gültepe N and Kiliç Z 2013 Scientific Argumentation and Conceptual Understanding of High School Students on Solubility Equilibrium and Acids and Bases *Journal of Turkish Science Education* **10** pp 5-21
- [9] Schwartz Y, Ben-Zvi R, and Hofstein A 2006 The Use of Scientific Literacy Taxonomy for Assessing The Development of Chemical Literacy Among High-School Students *Chemistry Education Research and Practice* **7** pp 203-225
- [10] Sukmadinata N S 2015 *Metode Penelitian Pendidikan* (Bandung: Rosdakarya)
- [11] Arikunto S 2010 *Prosedur Penelitian* (Jakarta: Rineka Cipta)
- [12] Riduwan 2012 *Skala Pengukuran Variabel-Variabel Penelitian* (Bandung: Alfabeta)
- [13] Kemendikbud 2014 *Peraturan Menteri Pendidikan dan Kebudayaan Nomor 104 Tahun 2014 tentang Penilaian Hasil Belajar oleh Pendidik pada Pendidikan Dasar dan Pendidikan Menengah* (Jakarta: Departemen Pendidikan dan Kebudayaan)

- [14] Hake R R 1998 Interactive Engagement Versus Traditional Methods: A Six Thousand Student Survey of Mechanics Test Data for Introductory Physics Courses *American Journal Physics* **66** pp 64-74
- [15] Arends R I 2012 *Learning to Teach* (New York: Mc Graw Hill)
- [16] Slavin R E 2011 *Psikologi Pendidikan: Teori dan Praktik Edisi Kesembilan* (Jakarta: PT. Indeks)
- [17] Andersen L W 1981 *Assessing Affective Characteristic In The Schools* (Boston: Allyn and Bacon)