Science Literacy in Indonesia: A brief picture of status, challenges and forward

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The Illiterate of the 21st century will not those who cannot read and write, but those who cannot learn, unlearn and relearn (Alvin Tovler)
“Literacy is the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society” (The United Nations Educational, Scientific and Cultural Organization (UNESCO))

How Indonesia embrace this challenges ??
The Facts
Population: 270,958,447
Area cover: 2,905,000 km²
Ethnic groups: >300
Language: >700 living languages
GDP: 1042.17 billion US dollars in 2018
ICP: 3,893.6 US dollars
Schools: 307,655
Students: 45,379,879
Teachers: 2,275,020
Science teachers: 133,925

Goal of education
Education is an effort to promote the growth of character, mind (intellectual and competence) and body of the child (skills-literacy). These parts cannot be separated so that we can completeness of our children’s lives (KHD)

LITERACY IS THE ULTIMATE OF NATIONAL EDUCATION GOALS

Good Citizen
Character
Competence
Literacy
Education dominates national spending and 20% of the budget has to go to education. It is the fifth-fastest improving education system. We have solved development 1.0 (Schools have been built, key legislation and polices are in place, teachers have been recruited in large numbers and data are being gathered and analysed).

Only a slight improvement in the skills of Indonesian 15-year-old students. This does not correspond to the amount of resources that the government invests in education. Less success in development 2.0 (use existing resources more efficiently.)

Indonesia: 3.1% of GNP (20% of Annual National Budget)
- Thailand: 3.9% of GNP
- Vietnam: 5.5% of GNP
- Malaysia: 5.9% of GNP
- Laos: 3.3% of GNP
- Cambodia: 2.7% of GNP
- Philippines: 2.7% of GNP

(UNESCO, 2012)
Indonesia in literacy realms

What is worth knowing for Indonesian?

- personal needs
- societal needs
- global needs
How should students think?

- Logically,
- independently,
- objectively,
- skeptically,
- critically,
- and rationally
- to reason scientifically and solve problems.

Behaviors and attitudes?

What type of future citizens do we want to prepare?

The five principles National Identity of Pancasila?
Science Teaching Processes Challenge in Indonesia: Ready-Made to Inquiry knowledge

• Dewey (1910, p. 25) noted, “Science teaching has suffered because science has been so frequently presented just as so much ready-made knowledge, so much subject-matter of fact and law, rather than as the effective method of inquiry into any subject-matter.”

How science education process guides our nation toward a scientifically literate society?

Common elements of science literacy in Indonesia

Knowledge:
• facts
• concepts
• vocabulary

Skills:
• manipulative
• intellectual:
  • scientific reasoning
  • critical thinking
  • problem solving

Dispositions:
• attitudes
• behaviors
Unseen National Challenge with A broad perspective in Science Literacy in Indonesia

Science ↔公共 ↔ CULTURAL DISTANCE

LITERACY AND 21ST CENTURY SKILLS IN NATIONAL CURRICULUM
Nasional Literacy Movement (2016)

1. Family Literacy
2. School Literacy
3. Teacher and education personnel literacy
4. Language and literature literacy
5. Culture Literacy
6. Society Literacy

Learning strategies to foster social and emotional skills
ONE of INDONESIAN way to Achieve Science Literacy in teacher training

Levels of Inquiry of Science Teaching

<table>
<thead>
<tr>
<th>Discovery Learning</th>
<th>Interactive Demonstration</th>
<th>Inquiry Lesson</th>
<th>Inquiry Lab</th>
<th>Real-world Application</th>
<th>Hypothetical Explanation</th>
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Teacher Locus of Control Student

- Low
- Intellectual Sophistication
- High

- Each level has associated with it progressively more sophisticated intellectual and scientific process skills.

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Curriculum Development in Indonesia

- 1947 Lesson Plan → Specified in Lesson Plan Elaboration
- 1964 Primary School Education Plan
- 1973 Development School Pioneer Project (DSPP) Curriculum
- 1975 Primary School Curriculum
- 1984 1984 Curriculum
- 1994 1994 Curriculum
- 2004 Competence Based Curriculum (CBC) Pioneer
- 2006 Unit Level of Education Curriculum (ULEC)
- 2013 Curriculum

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### Change Science Curriculum

<table>
<thead>
<tr>
<th>No</th>
<th>Previous Curriculum</th>
<th>Current Curriculum</th>
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<tbody>
<tr>
<td>1</td>
<td>The learning material is presented separately in Physics, Chemistry, and Biology</td>
<td>The learning material is presented integrated, no more separation between Physics, Chemistry, and Biology</td>
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<td>2</td>
<td>No platform, all studies stand in line</td>
<td>Use Biology as a study platform with consideration of all natural events and phenomena associated with the objects and their interactions among these objects. The goal is to emphasize the importance of interaction of biology, physics, chemistry and their combinations in forming a stable bond.</td>
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<td>3</td>
<td>Earth and space science materials is still inadequate [partly discussed in Social]</td>
<td>Completed with earth and space science materials in accordance with international standards</td>
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<td>4</td>
<td>The material tend to be superficial and memorizable</td>
<td>The material enriched with the needs of students to think critically and analytically in accordance with international standards</td>
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<tr>
<td>5</td>
<td>Learning materials were taught by different teachers (team teaching) with certification based on the subject.</td>
<td>Learning materials are taught by a teacher who gives an insight into the integrated subject area so that students can understand the importance of integration between subjects before studying them in detail separately in the next education level</td>
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### Steps of Strengthening Process of Literacy (all Subjects)

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<tr>
<th>Process</th>
<th>Strengthening Characteristics</th>
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<tbody>
<tr>
<td>Teaching and Learning Process</td>
<td><strong>Applying scientific method</strong> by observing, asking, experiencing, thinking,.....</td>
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<td></td>
<td>Using science and knowledge as a teaching and learning motor for all subjects.</td>
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<td>Encourage students to find out the information, not to be informed [discovery learning]</td>
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<td>Emphasizing the language competence as a tool of communication, knowledge carrier, and having competence of logical, systematic and creative thinking.</td>
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<td>Assessment</td>
<td>Assess students’ level of thinking starting from low to high</td>
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<td>Emphasizing deep thinking question (not merely memorizing)</td>
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<td>Assess students working process, not only the product</td>
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<td>Using students’ learning portfolio</td>
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</table>
2013 curriculum is an integrated effort of (1) reconstruction of graduate competency, with (2) suitability & sufficiency, broadness & depth of materials, (3) educational revolution and (4) evaluation reform .......

Competency linkages between levels of education
Future Effort: Public Understanding of Science

- Scientific Literacy
- Public Understanding of Science (PUS)
- Public participation of Science

Curriculum and Lesson in Teacher-Students Classroom

Science Lesson beyond the classroom
(Museum – Science Theater – Science Projects

School-Parents-Scientist Partnership (SP-SP)

All concepts relate to how the public perceive Science.

Research findings (science lesson beyond classroom)

1. Better in understanding the science concept (Awaluddin, 2010)
2. Have higher achievement (Kurniawan, 2011)
3. Observation skill increase 100%, prediction 60% and interpretation 65% (Rachmawati, 2013)
4. Science literacy evidence base has increase 17,99% (Kurniasih, 2013)
5. Student behavior toward science increase 78,7 % (Balitbang, 2016)
Science Lesson beyond the class room

Making Robotic
This is inline with Definition of Scientific Literacy By PISA

“Scientific literacy is the capacity to use scientific knowledge, to identify questions and to draw evidence based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity. (OECD, 2003, p133)