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The compatibility analysis of subject matter description with basic competence at science textbook for 7th grade of junior high school

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Abstract. The aim of this research is to analyze the quality of science textbooks for 7th grade of Junior High School in Bandung City. This research use content analysis method and data analysis with quantitative descriptive analysis technique. The compatibility analysis of subject matter description with basic competence use instrument which adopted from the instrument of BSNP and based on three indicators, (1) completeness, (2) broadness, and (3) deepness. Completeness based on the presentation of subject matter, broadness based on the presentation of concept, definition, procedure, or example which support to the subject matter, and deepness based on subject matter explanation. The samples are one electronic textbook (BSE), be code in A and two non-electronic textbooks (non-BSE), be code in B and C. The samples selected by purposive sampling technique. Analysis result shows that the completeness of book A, B, and C are 100%, 96,15%, and 96,15% consecutively. The broadness of book A, B, and C are 100%, 88,46%, and 84,62% consecutively. The deepness of book A, B, and C are 92,31%, 88,46%, and 73,08% consecutively. So, book A (BSE) have better quality than book B and C (non-BSE).

1. Introduction

The textbook is the important element and most often used by teachers and students for instruction and learning in science lesson. Weiss, Nelson, Boyd and Hudson [1] reported that 90% of all science teachers use textbooks for classroom instruction. Based on the research result, [2] explained that pattern of use of textbooks at school was quite different to that at university, with expectations regarding the use of textbooks being more structured and consistent at school. The textbook at school has some function according to [3], these are development tool of matters and programs in education curriculum, facilitate academic work of the teacher, facilitate achievement of objectives learning, and facilitate the efficiency and effectiveness of learning activities. [4] explained that textbook should be helpful to understand the main scientific concepts easily. Main scientific concepts should be presented deeply in the textbook, but the presentation should not bring on misconceptions. Woodward, Elliott, and Nagel [in 5] explained that teachers rely on textbook programs to supply not only subject matter

content, but also teaching strategies and tactics in the form of elaborately worked out approaches to the presentation of the major school subjects and detailed lesson plan. BouJaoude [in 6] explained that teaching, assessment, and the quality of textbooks used are also important factors that need to be considered if students' experience with science is to be complete and fulfilling. The central position of the textbook in instructional and learning needs serious attention by teacher. Davis [in 7] asserts, for successful teaching, it is essential that preservice and also inservice teachers are encouraged to look critically at curriculum materials and science textbooks. Based on the same reasons as explained above, Indonesian government by [8] ensures the quality of textbook by four feasibility criteria; these are content, language, presentation, and graphic feasibility. The quality criteria of Indonesian textbook and International textbook such as in United States of America (USA), England, or Turkey is same basically. The difference lies in the concern at specific issue such as gender and the most important is the involvement of many people with diverse expert in the textbook preparation. One of the most important of textbook criteria is content feasibility which can be assessed by the compatibility of the subject matter description with basic competence. This reason agrees with [7] that the intentional selection of "traditional science textbooks" was made on two bases: First, in the context of novel curriculum implementations. Basic competence based on [9] is some competences which student has in the certain subject matter as the reference for arranging competence indicator. The compatibility of subject matter description with basic competence in science textbook can guarantee that all students in Indonesia can get the same standard of subject matter, so that the quality of education can be spread evenly. The compatibility of subject matter description with basic competence based on [3] has three indicators, (a) completeness, (b) broadness and (c) deepness. Completeness based on the presentation of subject matter, [3] explained that the indicator of subject matter completeness is the matter which presented in the textbook at least load all of the subject matter that supports reach of Competence Standard (SK) and Basic Competence (KD) which have been formulated in subject curriculum concerned. Broadness indicator based on explanation [3] is the presentation of the concept, definition, principle, procedure, examples, and training found in the textbook by the need of subject matter that supports reach of Competence Standard (SK) and Basic Competence (KD). Deepness based on [3] is the description of the matter should be by the cognitive, affective, and psychomotor aspect that requested by SK and KD. The level of difficulty and complexity of the subject matter tailored to the student level of cognitive development.

Although the textbooks are attainments of teacher or lecture which is believed to have qualified in the field but did not rule contained, little or lot, things that do not meet the standards, as described by [10] in National Agency of Education Standards (BSNP) bulletin that there are many textbooks that has not been rated and needs assessment in order to meet the standards set in accordance with Government Regulation (PP) number 19 year 2005 and Ministry Regulation number 22 and 23 year 2006. The same explanation by [3] that there are textbooks that are not by the demands of the curriculum, contains only points of the matter (a kind of summary), and highly technical

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description. The same report based on TIMSS research (in Schmidt et al., 1997) given by [11], that textbooks in the United States cover many more topics, in less depth, than those in other, higher achieving countries. [1] Report too that the Chinese ordinary high school biology textbook does not include a sufficient number and variety of phenomena relevant to the set of key ideas. Central concepts in the textbook are not covered in enough depth to give students a chance to truly understand them. [4] Report that the content distribution is not systematized and is fractured into piece also said that the relationships among the concepts are weak and also there is no content integrity. [12] asserts, that the highly competitive textbook market has caused publishers to include as many topics as they can, and this has resulted in the thickest textbooks found in the world. In specific research result, [13] explained that only nine of the educators (56%) were of the opinion that sufficient content knowledge regarding the topic of heat was presented in their textbooks. The other seven educators (44%) wanted more content and more explanations of interesting phenomena. The opposite result given by [14], based on their research result about published textbook analysis in Pakistan, the compatibility content of General Science textbook and demand of curriculum get maximum score at all textbooks. Based on this problem and central position of science textbook in instructional and learning activities, need to be an analysis about the quality of existing science textbooks.

2. Research Methodology

This research use content analysis method. According to [15] that research conducted on the information documented in recording images, sounds, text, or other forms of recording, commonly known as analysis research documents or content analysis. The samples are three science textbooks for 7^{th} grade and selected by purposive sampling technique. One book is electronic textbook (BSE), be code in book A. The other two are non-electronic textbook (non-BSE) and be code in book B and book C. The BSE is compulsory textbook that has been assessed and determined by government and non-BSE is textbook that has not been assessed and determined by government but circulates in the market and commonly used by students and teachers. The process of collecting the data source of BSE done in 5 Junior High Scholl which representing five rayon in Bandung City, these are East Bandung, West Bandung, South Bandung, North Bandung and Southeast Bandung, while non-BSE selected from textbooks that are widely circulated in the market and popular use by students.

The compatibility analysis of subject matter description with basic competence use the instrument which adopted from BSNP instrument and based on three indicators, (1) completeness, (2) broadness, and (3) deepness. The basic competence that used in this research based on Curriculum 2006 with total 26 basic competences (KD). The subject matter that presented in the textbook is judged compatible with basic competence if the subject matter has met all of the completeness, broadness, and deepness indicators. Data analysis use quantitative descriptive analysis technique and the textbook analyzed by each chapter. For next, to know number of subject matter that compact with KD, be calculated with percentage technique, as follows:

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$$\%=\frac{\text{Number of KD that presented with meet criteria}}{\text{Total number of KD}} \text{ x } 100\%$$

3. Results of the Research

3.1. Completeness

There are two KD of book B and one KD of book C that the subject matter is not complete. The result summarized as follows:

Table 1. List of KD did not meet the completeness criteria at subject matter presented in textbook

Book	List of KD	List of Concept on KD
A	-	KD 4.2: Separation of mixtures
B	KD 4.2	
C	KD 4.2	

Book B and C did not present the subject matter about separation of the mixture based on chemical properties while book A presented that matter such as addition coagulation at processing of fresh water by water district corporation. Book B and C just presented the matter about separation of the mixture based on Physics properties such as filtering, distillation, decantation, etc. whereas KD 4.2 require the matter about separation of the mixture based on Physics and chemical properties.

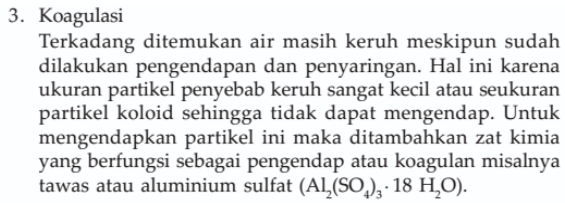

3. Koagulasi
Terkadang ditemukan air masih keruh meskipun sudah dilakukan pengendapan dan penyaringan. Hal ini karena ukuran partikel penyebab keruh sangat kecil atau seukuran partikel koloid sehingga tidak dapat mengendap. Untuk mengendapkan partikel ini maka ditambahkan zat kimia yang berfungsi sebagai pengendap atau koagulan misalnya tawas atau aluminium sulfat ($Al_2(SO_4)_3 \cdot 18\ H_2O$).

Figure 1. Mixture separation based on chemical properties at book A

3.2. Broadness

There are three KD of book B and four KD of book C that its subject matter not meets the criteria of broadness. The result summarized as follows:

Table 2. List of KD did not met the broadness criteria at subject matter presented in textbook

Book	List of KD	List of Concepts on KD
A	-	KD 1.2: Definition of temperature and its measurement
B	KD 1.2, 4.1, 4.2	KD 4.1: Physics and chemical properties KD 4.2: Separation of mixture
C	KD 4.2, 4.3, 5.1,	KD 4.3: Physics al and chemical change

7.2	KD 5.1: Natural phenomena of biotic and abiotic KD 7.2: the diversity of living things and preservation of ecosystems

Book B at KD 1.2 presented kind of thermometer too expand which include the bimetal thermometer, barrier thermometer, thermocouple, gas thermometer, pyrometer, and infrared thermometer. Explanation of bimetal thermometer, barrier thermometer, thermocouple, gas thermometer, and pyrometer be judged too early for Junior High School students.


1) Termometer bimetal

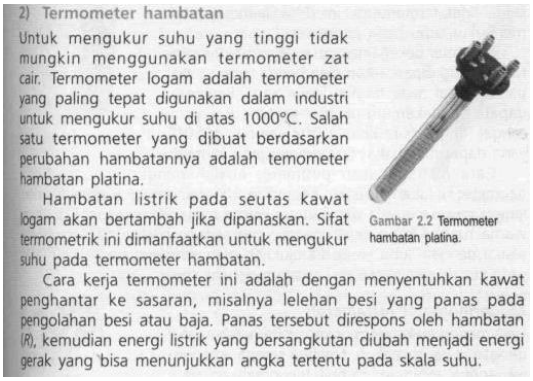
Jika kamu perhatikan skala pengatur berbagai mesin otomotif, misalnya spidometer pada kendaraan bermotor, maka kamu akan melihat bahwa kendaraan yang melaju cepat, mesinnya cepat panas dan spidometer menunjukkan angka kelajuan yang besar. Jika kendaraan melaju pelan, mesin tidak cepat panas dan spidometer akan menunjukkan angka kelajuan yang kecil. Jenis termometer ini adalah termometer bimetal yang menggunakan logam sebagai bahan untuk menunjukkan adanya perubahan suhu dengan prinsip logam akan memuai jika dipanaskan dan menyusut jika didinginkan.

Keping bimetal Ujung tetap

°C

Gambar 2.1 Termometer bimetal

Prinsip kerjanya, keping bimetal dibentuk spiral dan tipis. Ujung spiral


2) Termometer hambatan

Untuk mengukur suhu yang tinggi tidak mungkin menggunakan termometer zat cair. Termometer logam adalah termometer yang paling tepat digunakan dalam industri untuk mengukur suhu di atas 1000°C. Salah satu termometer yang dibuat berdasarkan perubahan hambatannya adalah temometer hambatan platina.

Hambatan listrik pada seutas kawat logam akan bertambah jika dipanaskan. Sifat termometrik ini dimanfaatkan untuk mengukur suhu pada termometer hambatan.

Gambar 2.2 Termometer hambatan platina.

Cara kerja termometer ini adalah dengan menyentuhkan kawat penghantar ke sasaran, misalnya lelehan besi yang panas pada pengolahan besi atau baja. Panas tersebut direspons oleh hambatan (R), kemudian energi listrik yang bersangkutan diubah menjadi energi gerak yang bisa menunjukkan angka tertentu pada skala suhu.

Figure 2. and 3. Explanation of Bimetal thermometer (left) and Barrier thermometer (right) at book B

The subject matter of Physics and Chemical Properties (KD 4.1) at book B is too brief (just 1,5 page). The subject matter of Mixture Separation based on chemical properties (KD 4.2) at book B and C did not met criteria of broadness because that subject matter not presented complete, so every subject matter not presented completely will not meet criteria of broadness or deepness because there is not subject matter presented. At KD 4.3 and KD 5.1, the subject matter presented at book C did not support with practice content about Physics al change and observation of biotic and abiotic natural phenomena whereas KD 4.3 and KD 5.1 require these contents. These practice contents demand of in their KD text, there are conclude Physics al and chemical change based on simple experiment result (KD 4.3) and do the patterned and systematic observation to get information about biotic and abiotic natural phenomena (KD 5.1). At another subject matter, book C presented that subject matter of diversity of living things is too expand which include various types monera, algae, fungi, euglena, moss, plants, classification of dicotyledonous, and characteristic of vertebrate and invertebrate animals.

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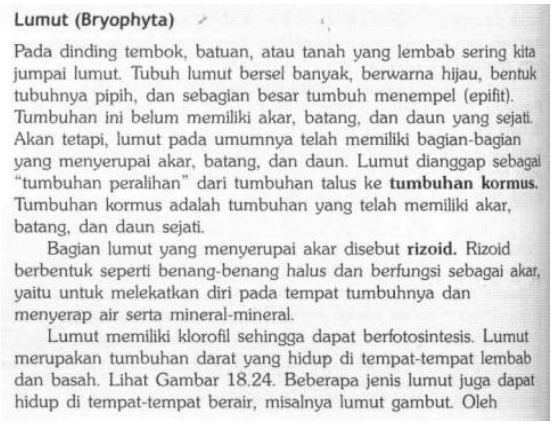


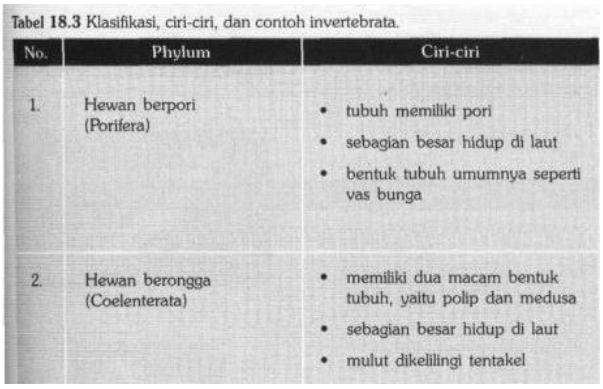
Lumut (Bryophyta)

Pada dinding tembok, batuan, atau tanah yang lembab sering kita jumpai lumut. Tubuh lumut bersel banyak, berwarna hijau, bentuk tubuhnya pipih, dan sebagian besar tumbuh menempel (epifit). Tumbuhan ini belum memiliki akar, batang, dan daun yang sejati. Akan tetapi, lumut pada umumnya telah memiliki bagian-bagian yang menyerupai akar, batang, dan daun. Lumut dianggap sebagai "tumbuhan peralihan" dari tumbuhan talus ke **tumbuhan kormus.** Tumbuhan kormus adalah tumbuhan yang telah memiliki akar, batang, dan daun sejati.

Bagian lumut yang menyerupai akar disebut **rizoid.** Rizoid berbentuk seperti benang-benang halus dan berfungsi sebagai akar, yaitu untuk melekatkan diri pada tempat tumbuhnya dan menyerap air serta mineral-mineral.

Lumut memiliki klorofil sehingga dapat berfotosintesis. Lumut merupakan tumbuhan darat yang hidup di tempat-tempat lembab dan basah. Lihat Gambar 18.24. Beberapa jenis lumut juga dapat hidup di tempat-tempat berair, misalnya lumut gambut. Oleh

Figure 4. Subject matter about moss at book C



Tabel 18.3 Klasifikasi, ciri-ciri, dan contoh invertebrata.

No.	Phylum	Ciri-ciri
1.	Hewan berpori (Porifera)	• tubuh memiliki pori • sebagian besar hidup di laut • bentuk tubuh umumnya seperti vas bunga
2.	Hewan berongga (Coelenterata)	• memiliki dua macam bentuk tubuh, yaitu polip dan medusa • sebagian besar hidup di laut • mulut dikelilingi tentakel

Figure 5. invertebrate characteristic at book C

3.3. Deepness

There are two KD of book A, three KD of book B, and seven KD of book C that presented not meet the criteria of deepness. The result summarized as follows:

Table 3. List of KD did not meet the deepness criteria at subject matter presented in textbook

Book	List of Basic Competences	List of Concept on Basic Competences
A	KD 1.3, 2.1	KD 1.3: Basic measurement KD 2.1: Acid, base, and salt properties
B	KD 3.4, 4.1, 4.2	KD 2.3: Element name and chemical formula KD 2.4: properties of elements, compounds, and mixtures
C	KD 2.3, 2.4, 4.2, 4.3, 4.4, 5.1, 7.2	KD 3.4: Heat KD 4.1: Physics and chemical properties KD 4.2: Separation of mixture KD 4.3: Physics al and chemical change KD 4.4: Chemical reaction KD 5.1: Natural phenomena of biotic and abiotic KD 7.2: the diversity of living things and preservation of ecosystems

The subject matter presented at Book A related to KD 1.3 is not detail, the procedure to read measurement result of caliper and micrometer screw is not clearly. There are not clear instruction how to read the main scale and the nonius scale value, such as if measurement value of the main scale there are between two numbers, which one should be used. A technical procedure like this did not explain by book A.

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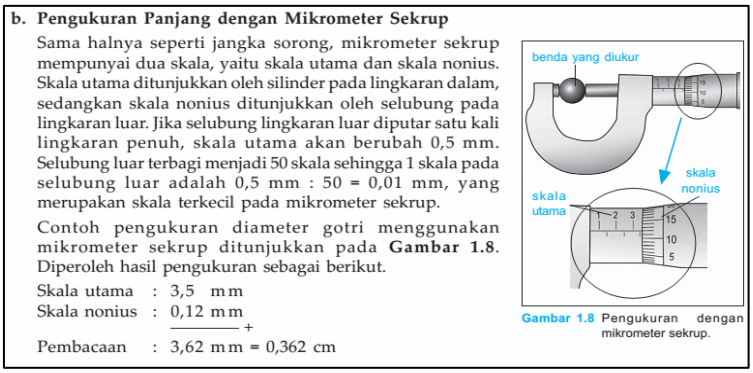


b. Pengukuran Panjang dengan Mikrometer Sekrup

Sama halnya seperti jangka sorong, mikrometer sekrup mempunyai dua skala, yaitu skala utama dan skala nonius. Skala utama ditunjukkan oleh silinder pada lingkaran dalam, sedangkan skala nonius ditunjukkan oleh selubung pada lingkaran luar. Jika selubung lingkaran luar diputar satu kali lingkaran penuh, skala utama akan berubah 0,5 mm. Selubung luar terbagi menjadi 50 skala sehingga 1 skala pada selubung luar adalah 0,5 mm : 50 = 0,01 mm, yang merupakan skala terkecil pada mikrometer sekrup.

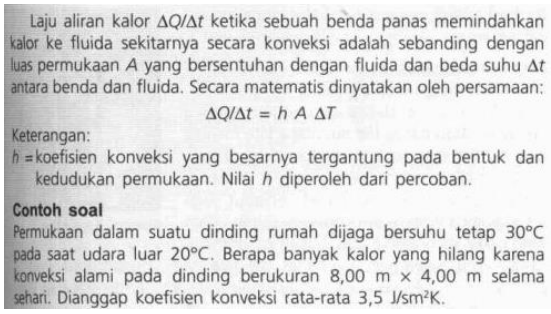
Contoh pengukuran diameter gotri menggunakan mikrometer sekrup ditunjukkan pada **Gambar 1.8**. Diperoleh hasil pengukuran sebagai berikut.

Skala utama : 3,5 mm
Skala nonius : 0,12 mm +
Pembacaan : 3,62 mm = 0,362 cm

Gambar 1.8 Pengukuran dengan mikrometer sekrup.

Figure 6. Subject matter of Measurement with Micrometer Screw at book A

Book A explained acid and base properties (KD 2.1) include ionization concept while another book not presented. The ionization concept more appropriate presented at Senior High School level. At KD 2.3, book C presented material on the nomenclature of the compound is too deep which include the naming of compounds with three constituent elements, moreover the explanation of nomenclature of the compound is not detail like the latin name of index number. Book C explaining the subject matter of Properties of Element (KD 2.4) involving the concept of Groups and Periods in the periodic table element while this material is too deep for Junior High School. Book B presented about Heat (KD 3.4) too deep that involves the concept of Thermal Conductivity, Convection Coefficient, and the Stefan-Boltzmann Equation. This matter is too complicated at the Junior High School level, and not by the demands of the deep of KD 3.4. Presentation of these matters as follows



Laju aliran kalor $\Delta Q/\Delta t$ ketika sebuah benda panas memindahkan kalor ke fluida sekitarnya secara konveksi adalah sebanding dengan luas permukaan A yang bersentuhan dengan fluida dan beda suhu Δt antara benda dan fluida. Secara matematis dinyatakan oleh persamaan:

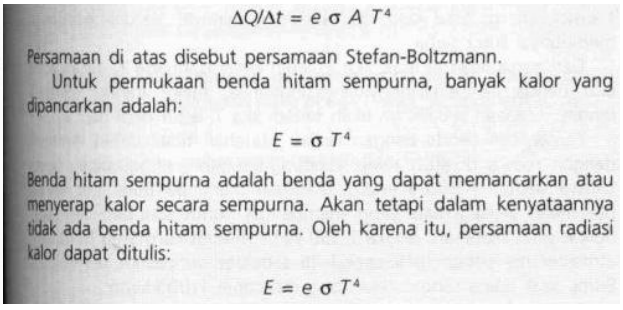
$$\Delta Q/\Delta t = h\ A\ \Delta T$$

Keterangan:
h = koefisien konveksi yang besarnya tergantung pada bentuk dan kedudukan permukaan. Nilai h diperoleh dari percoban.

Contoh soal

Permukaan dalam suatu dinding rumah dijaga bersuhu tetap 30°C pada saat udara luar 20°C. Berapa banyak kalor yang hilang karena konveksi alami pada dinding berukuran 8,00 m × 4,00 m selama sehari. Dianggap koefisien konveksi rata-rata 3,5 J/sm²K.

Figure 7. Convection Coefficient matter at book B



$$\Delta Q/\Delta t = e\ \sigma\ A\ T^4$$

Persamaan di atas disebut persamaan Stefan-Boltzmann.

Untuk permukaan benda hitam sempurna, banyak kalor yang dipancarkan adalah:

$$E = \sigma\ T^4$$

Benda hitam sempurna adalah benda yang dapat memancarkan atau menyerap kalor secara sempurna. Akan tetapi dalam kenyataannya tidak ada benda hitam sempurna. Oleh karena itu, persamaan radiasi kalor dapat ditulis:

$$E = e\ \sigma\ T^4$$

Figure 8. the Stefan-Boltzmann Equation matter at book B

Book B presented the subject matter of Physics and Chemical Properties (KD 4.1) less detailed, just like a summary. Book B did not present, such as a range of values of the Physics al properties of various substances such as boiling point and freezing point whereas demand of KD 4.1, there is compare Physics and chemical properties of various substances. Presentation of this matter at book B as follow

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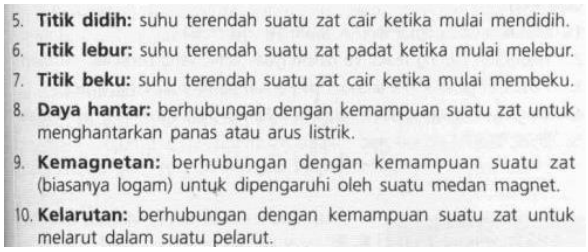
5. **Titik didih:** suhu terendah suatu zat cair ketika mulai mendidih.
6. **Titik lebur:** suhu terendah suatu zat padat ketika mulai melebur.
7. **Titik beku:** suhu terendah suatu zat cair ketika mulai membeku.
8. **Daya hantar:** berhubungan dengan kemampuan suatu zat untuk menghantarkan panas atau arus listrik.
9. **Kemagnetan:** berhubungan dengan kemampuan suatu zat (biasanya logam) untuk dipengaruhi oleh suatu medan magnet.
10. **Kelarutan:** berhubungan dengan kemampuan suatu zat untuk melarut dalam suatu pelarut.

Figure 9. Physics Properties matter that presented at book B

At the next KD, book B, and C presented subject matter of Mixture Separation (KD 4.2) have not met deepness criteria because there is no subject matter about mixture separation based on chemical properties. Book C at Physics and Chemical Change material (KD 4.3) actually be judged have met deepness criteria on all subject matter presented, except there is practice content about Physics change so that the deepness of that content cannot be assessed. Presentation of this practice content is important because the demand of KD 4.3 conclude the Physics and chemical change based on simple experiment results. Besides KD 4.3, book C presented another subject matter did not meet deepness criteria too; there is the subject matter of Chemical Reaction (KD 4.4). At this subject matter, the presentation about chemical reaction is too deep which include decomposition, decomposition due to heating, decomposition due to the flow of electricity, decomposition due to light, oxidation, reduction, neutralization, precipitation, exchange reaction, and fermentation. Book C did not present practice content about natural phenomena observation of biotic and abiotic so that the deepness of that content cannot be assessed, whereas the presentation of this practice content demand of KD 5.1. The last, book C presented the diversity of living things material (KD 7.2) which include subject matter about monera, algae, fungi, euglena, moss, plants, classification of dicotyledonae, and characteristic of vertebrate animals is too deep and detailed because these subject matter not only mentioned but also described in detail.

4. Conclusion and Discussion

Based on analysis result, all of the books have not met all of the criteria. Data that get from analysis and calculated with percent technique obtained that the completeness of book A, B, and C are 100%, 96,15%, and 96,15% consecutively. The broadness of book A, B, and C are 100%, 88,46%, and 84,62% consecutively. The deepness of book A, B, and C are 92,31%, 88,46%, and 73,08% consecutively. Based on these result and combine all criteria, so compatibility of subject matter with basic competences of book A, B, and C are 92,31 %, 84,61%, and 73,08% consecutively. All textbook have diverse quality. This result shows that still there is room for improving the textbook quality.

Based on the possibility of improving the textbook quality, there are things that we must think again, because the compatibility subject matter description with basic competence based on completeness, broadness and deepness criteria is basic feasibility criteria of science textbook but it turn out there are science textbook have not met these criteria, and on this research there are no textbooks which can meet all criteria. There

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some possibility that becomes the reason why this happened. Science textbook which contain by physics, biology, and chemistry subject matter must written by the expert in education and its science field. Book A write by two authors, book B by five authors, and book C by three authors. Book A and B did not explain the detail profile of their authors, but book C explained it and there is no author which specialty in chemistry field and there are possibility that the other books did not write by the author which field in Physics , biology, chemistry, and education expert all at once. International textbook such as Glencoe Science always involve many expert in various science field and education field. Perhaps, the another possibility is several authors not reviewing curriculum in detailed so that demand of basic competence not presented at the textbook or the author not refer to feasibility criteria which already arranged and published by BSNP. The analysis result of this research can take into consideration that all science textbook before disseminated in the school and the market must be assessed by the government to assure that all science textbook have standard feasibility. This idea support by the result of this research that book A which have assessed by BSNP have better quality regarding completeness, broadness, and deepness criteria than book B and C.

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