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Islam - Science Integration Approach in Developing Chemistry Individualized Education Program

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Abstract

The paper is based on a research which tries to explore, explain and describe Islam - science integration approach to develop an Individualized Education Program (IEP) for students with disabilities in chemistry lesson. As a qualitative case study, this paper is aimed at investigating how Islam - science integration approach can be underpinned for developing the IEP for Chemistry. Participants were recruited purposively and data were collected by interviews; documents' analysis; and experts' assessment (i.e. material experts, inclusive education experts, media experts, chemistry teachers and support teachers), then analyzed using content-analysis. The result shows Islam - science integration approach can be a foundation to develop the chemistry IEP by seeking support for the verses of the Qur'an and corresponding hadiths. Even although almost all the subject matter in chemistry can be integrated with Islamic values, this study only developed two contents, namely Periodic System of Elements and Reaction Rate.

Keywords: *Islam-science integration, IEP, students with disabilities, chemistry*

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Introduction

The rationale behind this paper is to explore and examine Islam-science integration as an approach in developing Individualized Education Program (IEP) for students with disabilities for a chemistry lesson. IEP is a document that should be provided to support students with disabilities in maintaining their learning process and achieving their targeted learning outcomes (NCSE, 2013). As an inclusive school, people at the policy level should have a commitment to give sufficient and adequate learning support for students with disabilities (Carrington & Elkins, 2002).

In the last two decades, inclusive education has become one of the special trending topics in the context of giving educational rights to all school-aged children. The Millennium Development Goal's (MDG) educational target is that by 2015 all children would be able to enjoy a full course of a basic education and now Indonesia is still working towards achieving this goal and securing Education for All. Unfortunately, educational MDG targets (MGD2) have not been achieved and "around 3 to 5 percent of Indonesian children aged 7 to 14 are still not enrolled in school by 2015" (Lundine, Hadikusumah, & Sudrajat, 2013). Therefore, the government issued a 12-year compulsory education (primary to secondary) policy that replaces the previous policy of mandatory 9 years (Ikrom et al., 2015). All children without exception (including disabilities) shall be a part of 12-year compulsory education by 2020. This means, by 2020 all children should be learning in school for 12 years. This regulation has been issued to get children with disabilities can take in educational services. The Ministry of Education has guaranteed through the affirmation that all school age children funded by the government through the School Operational Assistance program (Anonym, 2014).

Regarding to students with disabilities in participation to education, in fact, only 10 – 11% of a total 1.6 million Indonesian students with disabilities have obtained their educational services in 2015 (Muhammad, 2015). Nevertheless, those who attended public schools were segregated from their peers without disabilities. More specifically in Special Province of Yogyakarta (DIY), statistical data of the Department of Education, Youth and Sports (*Dikpora*) shows in the academic year of 2017/2018, the number of students with disabilities, who are welcoming in special schools (SLB), are 4210 in primary special schools (SDLB and SMPLB) and 769 students in secondary special schools (SMALB). These numbers excess than students who are welcoming in mainstream schools, which are 2883 pupils in primary schools and 191 pupils in secondary schools (Department of Education, Youth and Sports of Special Province of Yogyakarta, 2017). The existence of persons with disabilities that certainly cannot be denied and must be taken into consideration in any development process to realize Yogyakarta as an inclusive city.

The number of students with disabilities in Yogyakarta is increasing dramatically from year to year (preliminary study based on statistical data of the Department of Education, Youth and Sports of Special Province of Yogyakarta in the last three years). This fact suggests that the government should seriously take over any problems related to the implementation of inclusive education both in primary and secondary education levels. Promoting and implementing the inclusive system and culture is not an easy way, because inclusive education often leads to an imposed set of rules and a specific system (Forlin, Chambers, Loreman, Deppeler, & Sharma, 2013). Understanding of inclusive education should be delivered to teachers, parents, and society. Teachers in Indonesia still have the lack perception regarding inclusive education and their awareness of inclusive education is still low (Khayati, 2015). According to the interviews with teachers in inclusive schools in Yogyakarta in February 2015 and August 2016, the researcher concluded that teachers still have a misconception on the terminology of inclusive education and lack awareness to provide the right education to all students.

In fact, the number of students in Yogyakarta who attends special schools (SLB) is almost doubled than who welcomes in mainstream schools. It means parents prefer to send their children to special schools rather than inclusive schools. However, SLB segregation model is currently considered inappropriate because of disabilities that should be taught in separate classes often feel unmotivated, low self-esteem, and helpless (Salend, 2005, p. 17). It would be different if the students with disabilities placed in inclusive schools. The placement of children with disabilities in inclusive schools can foster a positive attitude for students with disabilities who thrive on communication and interaction of friendship and peer work (Mason, 2013). Children with disabilities learn social skills and are more well-prepared to face and stay in their community. Inclusion setting is an opportunity for social interaction between the disabled and the society in general. With the inclusive school, children avoid the negative effects of school segregation and labelling defects that stigmatize children of school segregation makes the child feel inferior, little possibility for mutual cooperation and respect for diversity (Foreman, 2001). On the other hand, a study was conducted by Bruster claiming that the special education teachers were clearly more positive than general education teachers about the inclusion of students with disabilities, the influence of students with disabilities in the general education classroom and its students, and the management of behavior in the inclusive classroom (Bruster, 2014).

Since the enactment of Regulation Yogyakarta Mayor, No. 47/2008 on the Implementation of Inclusive Education System (SPPI) in the municipality of Yogyakarta, Inclusive Education begins to be implemented intensively (Hanjarwati & Aminah, 2014). Since the local regulations has been issued in 2008, the number of inclusive schools in Yogyakarta recorded significantly have increased as much as 163 in primary and 57 in secondary levels (Department of Education, Youth and Sports of Yogyakarta, 2016). This amount was also not able to accommodate the needs of students with disabilities, including in the learning process even tend to reject. Nevertheless, the government of the municipality of Yogyakarta has endeavored to provide facilities for improving the quality of learning of students with disabilities by providing Support Teacher (*Guru Pendamping Kelas/GPK*) for inclusive schools and established a Resource Center (RC) as the gathering place of the GPK and inclusive education practitioners.

Several studies have been conducted related to inclusive education. Andriadi conducted his research at MAN Maguwoharjo and he concluded that regardless of MAN Maguwoharjo who lacks specific guidance for managing inclusive classes, students with disabilities can still adjust the learning situation (Andriadi, 2013). The historical background as the first inclusive school in Yogyakarta affects teachers and staff to provide the best services to students with disabilities, the existing infrastructure is very suitable and accessible to students, and cooperation between schools and surrounding communities as well as local governments supports the realization of inclusive education.

Focus on learning problems, students with disabilities in high school usually should take social science courses without considering talent and interest. A study at one inclusive school in Yogyakarta municipality, concluded that teachers found some difficulties to teach students with disabilities especially for science (physics, biology, and chemistry) and mathematics subjects (Khayati, 2015). In addition, students with disabilities rarely engage in the laboratory activities. Teachers said they do not have specific strategies for teaching in inclusive classes. According to Fitriyani, blind students in MAN Maguwoharjo and SMAN 1 Sewon are still actively involved in chemistry laboratory activities, although they only have limited participation (Fitriyani, 2012; Suprihatiningrum & Fitriyani, 2014).

Other facts show that the learning media of chemistry for blind students in inclusive schools in Yogyakarta is also very limited (Satrio, 2016; Umiyati, 2013). Teachers do not provide instructional materials that students can access and do not use assistive technology, so they cannot study independently according to their disabilities. The two-mainstream media are Braille module and screen reader. Unfortunately, not all chemistry teachers can read and write in Braille and have access to language interpreter (Braille reader). During this time, students with disabilities are highly dependent on the GPK assigned to provide additional lessons outside the classroom.

As the number of students with disabilities has been increasing, therefore it would be necessary to train teachers in how to maintain teaching and learning process in their classroom when welcoming students with disabilities (Bowlin, 2012). For example, in the Chemistry classroom, teachers need to be trained in how to provide appropriate learning strategies, adapt learning media and offer students with disabilities to involve in the laboratory activities. In general, three basic requirements for a teacher to succeed in adapted chemistry education are; 1) knowledge regarding students with disabilities, 2) providing adaptative teaching according to their disabilities and 3) designing and implementing an Individualized Education Program (IEP) (Kokaridas et al., 2014). IEP is designed to help Chemistry teachers to meet the unique educational needs of the child with disabilities, develop goals and objectives that correspond to the needs of the student and improve the level of performance and achieve goals in education (Auxter & Pyfer, 2001). Schools which receive students with disabilities should provide IEP for each of them (Miner, Nieman, Swanson, & Woods, 2001). The IEP creates an opportunity for teachers, parents, school administrators, related services personnel and students (when appropriate) to work together to improve educational results for children with disabilities (Blanton, Pugach, & Florian, 2011).

As an educational tool for students with disabilities, teachers should design and implement the IEP. Unfortunately, preliminary study in August 2016 concluded in most of inclusive schools in Yogyakarta, teacher has yet to prepare IEP and they still have a lack of perception and understanding about IEP, the function, and how to develop it. If they have students with disabilities in their class, they use regular lesson plans and give them extra lessons outside of the classroom provided by the teacher support. Teachers never carried out intervention programs to increase student with disabilities' participation in the classroom and improve their learning outcomes in general.

Problems faced by chemistry teachers in providing appropriate access to students with disabilities can be minimized by developing an IEP before they start learning. This IEP not only will guide a chemistry teacher in how to teach students with disabilities, but also give a responsibility to all school members to offer a friendly-environment to students with disabilities.

Concerning with dramatically changing in Indonesian curriculum for primary and secondary schools in the last decade, it is noticeable that government has amended the curriculum for several times and Curriculum 2013 is the latest version. One striking feature of the new curriculum is that it has a mandate for teachers to develop their instruction and integrate the subject with 'values' (Regulation of the Minister of Education and Culture No. 22 year 2016 on Standard Process of Primary and Secondary Education), i.e. by linking the materials with local context and religion (at this study is by Islamic values).

As for the concept of integration of Islam and science in the subjects have also been studied. Rosyada argued the integration of science and religion will be more effective by trying to dialogue science with religion on every subject matters, either through exploration of the explicit meaning of the verse with the theory of science, or bringing the science theory back to the verse by understanding *nash* cues, or at least inserting the spirit of religion in the axioms of science and technology, so that all the actions of Muslims have the weight of spirituality and become the act of worship as a Muslim (Rosyada, 2015).

Research conducted by Saputro concluded religious values can be included in textbooks of chemistry in secondary schools' level, methods of integrating religious values in high school chemistry textbook can be pursued through quotation of Qur'anic verses relating to the theme of chemistry in the beginning (apperception) or in the content of the description of the subject matter along with the explanation of the meaning contained in the verses (Saputro, 2011).

Embedding Islamic values into chemistry lesson is one of the formulas to build the good character. In order to do so, teachers are required to embed values into the lesson plan, syllabi and curriculum (subject matter). Related to students with disabilities, based on preliminary study in one inclusive school in Yogyakarta in August 2016, the syllabi and lesson plans do include values but had not been included Islamic studies (linking the chemistry and the Islamic studies). Teacher also has been difficult to implement it in the classroom. The lesson plan, syllabi and curriculum are designed for all students and Chemistry teachers have not provided a special document, which is called IEP, for students with disabilities to support their learning process. Therefore, teacher needs the model of IEP that contained value and integrated with Islamic studies. This study has tried to use Islam - science integration approach to develop the Chemistry IEP.

While there is not yet a legal requirement to provide IEP for children in Indonesia, many teachers of children with disabilities need this document to provide the best education services and to achieve the educational goals. In fact, there are many inclusive schools that have yet to develop and manage an IEP for students with disabilities, so that they must follow the general education program regardless of their condition and needs. Therefore, it is important to do the development and management of an IEP for students with disabilities in inclusive schools (Rudiyati, 2010).

Despite the enormous studies on IEP as a legal document provided by teachers as a guide to increase participation and achieve learning goals for students with disabilities, there are some scholarly gaps that can still be identified: First, limited studies have practically examined the Islam-Science integration approach in developing IEP. Second, most of the studies have involved the IEP as a document to improve teaching effectiveness and students with disabilities' achievement. Third, such a study has not been conducted in Yogyakarta Indonesia.

Therefore, the main purpose of this study is investigating how Islam - science integration approach can be used to develop Chemistry IEP for students with disabilities. The following research questions were employed to guide this study, are:

1. How Islamic content can be integrated with the development of IEP chemistry lessons?
2. How to develop an IEP for Chemistry using an Islam - science integration approach in providing better education services for students with disabilities in chemistry learning?

It is important that students with disabilities not only learn chemistry in general but also understand the chemistry contextually in everyday life and its relation to the teachings of Islam.

Research Method

Research Design

A detail, rich and depth exploration was required as the nature of the phenomenon of this study rather than a wide range scale assessment. Consequently, qualitative research methodology is the most suitable approach to use. This approach can develop new intellectual perceptions and to change the structure and condition of an educational setting (Denzin & Lincoln, 2003) and understand a social problem (which in this study is how Islam - science integration can be applied as an approach to developing Chemistry IEP for students with disabilities) as encountered by certain individuals or groups (Creswell, 2012; Punch, 2014a).

For the theoretical perspective, this study stuck on a pragmatic perspective. The primary concern of pragmatism is “action and change and the interplay between knowledge and action” (Goldkuhl, 2012, p. 136). Pragmatism can be perceived as a worldview that is based on actions of application and solutions of problems (Creswell, 2014; Punch, 2014c). Of the same view, Morgan (2014) argue “pragmatism as a philosophy goes beyond problem-solving is a key point” and it will suitable for analysis to solve the human activity problem. Thus, this study tends to focus on the research problem and then employs available theoretical approaches to solve the problem (Creswell, 2014) rather than merely observing the world (Goldkuhl, 2012).

This research also uses a case study as a strategy to answer the research questions. According to Punch, case studies involve four main characteristics: 1) bounded system, 2) clear identification of the case, 3) explicit attempt to preserve the wholeness of the case, and 4) using multiple sources of data and data collection methods (Punch, 2014b).

Participants and Recruitment of Participants

The participants were selected purposively and they recruited by mailed letters, which inform a brief explanation about this study and they have also filled out the consent form. The participants were the chemistry teacher, support teacher (GPK), chemistry material expert, inclusive education expert, media expert, students with vision impairment and hearing loss.

Data Collection Techniques and Procedures

Data were gathered through interviews, documents’ analysis and experts’ assessment as described in Figure 1. All the interviews were recorded using a voice recorder, translated, and transcribed.



Figure 1. Data Collection Techniques to Answer the Research Questions

Semi-structured interviews with principal, vice-principal and chemistry teacher were conducted to answer the research question 1. Gathered data from those interviews then were analyzed simultaneously with the second data collection technique, which is document analysis, which are Chemistry lesson plan, syllabi and curriculum (subject matter). These documents then were analyzed to seek which the verses of the Qur’an and corresponding hadiths were appropriate and suitable to support the subject matter of Chemistry.

To answer research question 2, the researcher then developed the IEP for Chemistry lesson (from assessing to writing step) based on the IEP Development Procedure under the Ministry of Education of British Columbia (1996) (Ausmus et al., 2009, pp. 7-20) as can be seen in Figure 2. The next step was asked the participants as an expert (material experts, inclusive education experts, media experts and chemistry teacher) to assess the IEP designed. This part which was called as a validation of IEP. The assessment form was designed based on several aspects, i.e.: 1) accommodation, 2) adaptation, 3) assessment for learning, 4) assessment of learning, 5) collaboration, 6) consultation and 7) approach in learning. These assessments result have been used for IEP improvement.

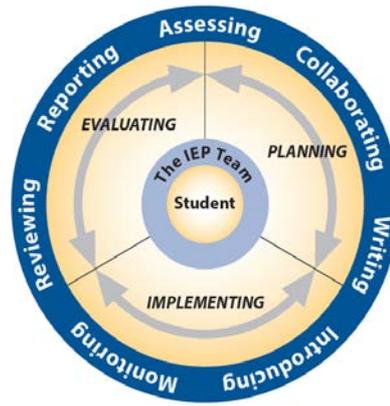


Figure 2. The Development Process of the IEP (Ausmus et al., 2009, pp. 7-20)

Data Analysis

As suggested by Merriam and Tisdell, the nature of this qualitative case study positions the researcher to collect and analyze the data simultaneously (Merriam & Tisdell, 2014). Data collected were categorized, indexed and cross-referenced to capture emerging themes (inductive analysis process) then operating a theoretical framework to guide the analysis (deductive analysis process) (Yin, 2014, p. 132).

Ethical Considerations

To ensure the ethical issues, this research was conducted by avoiding relationships that might harm the professional performance and involve voluntarily participants. In addition, the identity of participants was remained confidential and pseudonyms to guarantee the privacy and confidentiality of the data.

The Quality of the Study

The quality of a qualitative study can be maintained by four criteria as Guba suggestion, which are credibility, transferability, dependability, confirmability (Shenton, 2004). Purposeful sampling technique and a thick description of the phenomenon have been used to ensure the **credibility** (Patton, 2015, p. 533); number of participants involved, data collection method employed, number and length of data collection sessions as well as the period of data collection have been used to confirm the **transferability**; the possibility of replication of this study guaranteed the **dependability**; and the **confirmability** can be ensured by a detailed explanation of the method that led the readers to understand the findings (Shenton, 2004, p. 73).

Results and Discussion

An inclusive school has a responsibility to provide an appropriate learning for each student with disabilities as outlined in the IEP. Each IEP must be designed for the students and should be a document that is completely individualized. IEP creates an opportunity for teachers, parents, school administrators, and counsellors to cooperate in improving educational outcomes for students with disabilities (Yeager, 2014).

An IEP may usefully be thought of as a product. However, there is also a process involved in developing the plan and it is the quality of this process that determines the quality and effectiveness of the Plan. The IEP is developed through a collaborative process involving the school, parents, the student (where appropriate) and other relevant personnel or agencies (Ausmus et al., 2009). It refers to the adapted or modified aspects of the educational program and focuses on priority learning needs, although the student may also have other learning needs that will not require the same intensive degree of planning and monitoring. Not every aspect of the curriculum and school life needs to be modified for every student with special educational needs - only those areas of identified need arising from assessment should be covered. The amount of adaptation and support will vary according to the individual learning needs of each student. Some students with more complex needs may require significant educational modifications (Murray, 2006, p. 4).

IEP is intended to address problems unique learning of each student. The IEP must include certain information about the child and the educational program designed to meet his or her unique needs, which are (Küpper, 2000, pp. 8-9):

Current performance

The IEP must state how the child is currently doing in school (known as present levels of educational performance). This information usually comes from the evaluation results such as classroom tests and assignments, individual tests given to decide eligibility for services or during re-evaluation, and observations made by parents, teachers, related service providers and another school staff.

Annual goals

These are goals that the child can reasonably accomplish in a year. The goals are broken down into short-term objectives or benchmarks. Goals may be academic, address social or behavioral needs, relate to physical needs, or address other educational needs.

Special education and related services

The IEP must list the special education and related services to be provided to the child or on behalf of the child. This includes supplementary aids and services that the child needs. It also includes modifications (changes) to the program or supports for school personnel-such as training or professional development-that will be provided to assist the child.

Participation with children without disabilities

The IEP must explain the extent (if any) to which the child will not participate with nondisabled children in the regular class and other school activities.

Participation in state and district-wide tests

Most states and districts give achievement tests to children in certain grades or age groups. The IEP must state what modifications in the administration of these tests the child will need.

Dates and places

The IEP must state when services will begin, how often they will be provided, where they will be provided, and how long they will last.

Transition service needs

Beginning when the child is age 14 (or younger, if appropriate), the IEP must address (within the applicable parts of the IEP) the courses he or she needs to take to reach his or her post-school goals.

Needed transition services

Beginning when the child is age 16 (or younger, if appropriate), the IEP must state what transition services are needed to help the child prepare for leaving school.

Age of majority

Beginning at least one year before the child reaches the age of majority, the IEP must include a statement that the student has been told of any rights that will transfer to him or her at the age of majority.

Measuring progress

The IEP must state how the child's progress will be measured and how parents will be informed of that progress.

Some countries, i.e. the US, Australia, Canada, New Zealand and the UK mandate the educators to prepare and implement IEPs for children with special educational needs (Murray, 2006). The IEP in countries such as the US has a form of a legal document (Individuals with Disabilities Education Act Amendments 2004) and organized both in procedure and record keeping that is signed by everyone involved (teachers, parents, and local education authorities) so as to specify the most optimal educational environment and provisions given to disabled students (Kokaridas et al., 2014). In Greece, the IEP document contains a short report and general guidelines letter that are sent by "the state-run diagnostic evaluation centers" to school policy makers and signed by the student's legal caretakers (Kokaridas et al., 2014).

While some inclusive schools in Yogyakarta have not provided Chemistry IEP yet, it is essential to provide this document in maintaining the chemistry lesson when teacher welcoming students with disabilities. This study was intended to use Islam - Science integration approach as the foundation to develop the Chemistry IEP for student with disabilities. The results of this study are described as follows.

Integration of Islamic content with the development of IEP Chemistry lessons

Interviews with the principal, vice-principal of curricula and chemistry teachers in the targeted inclusive school generated a simple conclusion, that Islamic content and/or Islamic values can be integrated and embedded into Chemistry lesson, particularly in designing IEP. As an inclusive secondary school, NS, has provided several accessibilities and learning accommodations for students with disabilities. For instance, this school has provided a building that accessible for wheelchairs users and blind and/or visual impairment person. Specifically, for learning accommodation, this school has offered adaptive learning materials such as braille module for some lessons for students with vision

impairment, nevertheless digital recording or audio material for students with hearing loss is still very limited.

Another fact, the school culture in welcoming students with disabilities in this school is very well-established. The principal, teachers, staffs and students without disabilities are very welcomed to students with disabilities and supported them by providing a friendly-environment. But we do realize that making and establishing inclusive education is not easy and need a broad range of time. Teachers said that sometimes they get confused and have no idea what to do if they faced the students with disabilities in their classroom. It is because teachers have not adequate training related to making classroom accessible and helpful with students with disabilities. For instance, teachers did not realize that they should design and provide students with disabilities with the comprehensive document called Individualized Education Program (IEP). Teachers usually used their lesson plan, syllabi and curriculum as usual without made any modification and/or adjustment for students with disabilities. As known, for students with disabilities, a one-fit curriculum would not be worked (Gargiulo & Metcalf, 2015), rather than adjusting the curriculum based on the student's need. Hence, teachers should fix curricula rather than learners (CAST, 2011).

Concerning with the IEP for Chemistry lesson, even although teacher has not designed yet, integrating and embedding the Islamic values to the IEP is very possible to organize based on the teachers' perspective. Having the IEP contained the Islamic value would be beneficial for students (not only students with disabilities) in shaping their good character, improving knowledge and proving that Chemistry is closed to daily activities and stated in the holy book.

Many questions came from teachers about the integration form of Islamic value and IEP. Before developing the IEP, the researcher had a depth analysis on documents i.e. lesson plans, syllabi curriculum, the Qur'an and its recitation and the hadiths. The depth analysis on those documents has resulted a list of materials that suitable and can be underpinned with the Qur'an and hadiths, which are: Atomic Structure, Periodic System of Elements, Chemical Bonds, Stoichiometry, Thermochemistry, Reaction Rate, Chemical Equilibrium, Acid and Base, Buffer Solution, Hydrolysis, Solubility and Solubility Product, Colloids, Colligative Properties of Solutions, Redox and Electrochemical Reactions, Chemical Elements, Organic Compounds, and Macromolecules. Of the 18 subjects, two materials were selected to be developed into an IEP model for students with visual and hearing impairments, which were the Periodic System of Elements and the Reaction Rate.

Developing IEP for Chemistry using an Islam - Science Integration Approach to Support the Success of Chemistry Learning for Students with Disabilities

After confirming that Islamic contents and/or values can be integrated into Chemistry lesson (particularly in developing the IEP), the next stage was developing the IEP itself. The IEP designed for the two students with disabilities, one with vision impairment and another one with hearing loss. The initial step in developing the IEP is diagnose the students' needs related to Chemistry learning, as in the following explanation.

Need assessment of students with disabilities on chemistry learning based on their initial diagnose *Students with hearing impairment*

NS Secondary School has several students with disabilities, one of them is a student with hearing impairments. Based on the initial assessment, DI (name of the student) has been lost her hearing since elementary school by accident (falling in front of house). However, she can still hear at 2 m. In general, her mastery in technology/computer is at a good level and has a very high independence and does not require a companion. In the aspect of communication, a lip-reading technique is more frequently used than sign language. Her flexibility to read lips also helped her to communicate in academic and non-academic contexts. Regarded from the social aspect and maturity for adolescents of her age, DI is classified as good, she has a high self-confidence, able to self-organize, ready to live independently, and has good social skill.

Especially on the aspect of learning chemistry, DI likes this subject. Unfortunately, because of the limitations she has, especially in understanding abstract concepts, DI does not have an exhilarating achievement in chemistry subjects. However, DI has a strong motivation to study chemistry, because entering the chemistry department is one of her ambitions.

To gain her knowledge in chemistry, she needs various learning sources and approaches, one of them is discussing with teacher and peers. However, her classmates are sometimes reluctant to share knowledge and information to DI because most of them cannot use sign language. It can be said that language and communication barriers lead to learning barrier.

Students with visual impairment

TR as a respondent stated that he had total impairment since the age of 4 months due to the persistent fluid coming out of his eyes which then resulted in him being unable to see. TR has a talent in the field of language, proved he mastered in English, German and Arabic. Although having a visual loss, TR is able to work using the internet to search data/information well, including operating computers and smartphones and using it to interact with social media.

Regarded from the aspect of independence, TR has sufficient independence, such as using public transportation from dormitory to school and other places and able to find the location of its own class although not accompanied by his friend. A white-cane is used only if necessary when he is not already memorized that place. In addition, the mastery of reading Braille and reading with computer talk is good enough. From the aspects of attitude and social maturity, TR has a high sense of confidence and ability to communicate/socialize easily and flexibly with others.

As for chemistry learning needs, TR stated that: 1) Chemistry is fun and exciting subject, however, his conditions experienced cause chemistry to be quite difficult because most of the chemicals are abstract and visual; 2) the most interesting material is Atomic Structure, while the unattractive content is Reduction and Oxidation Reaction (Redox); 3) TR is not involved in practicum activities and he is rarely involved in group discussion; 4) a student with visual loss is not possible to go to college and take chemistry, because 80% of the chemicals are abstract and visual.

The Chemistry IEP Development Process

The Chemistry IEP development process will be described in the following explanation.

Assessment

This stage was done to assess the students with disabilities using an instrument contains several aspects related to the student with hearing and visual impairments. The instrument contains six aspects, namely cognitive (consisting of 19 indicators), emotions (consisting of 13 indicators), social (consisting of 15 indicators), motor (consisting of 11 indicators), behavior (consisting of 11 indicators), and others (consisting of 1 indicator). The assessment results have been explained in the previous section (see the section: need assessment of students with disabilities on chemistry learning based on their initial diagnose).

Collaboration

A collaboration was carried out by the researcher with the principal, vice principal of curriculum, chemistry teacher and support teacher by conducting several meetings. This collaboration was incorporated in the form of IEP development team. Cooperation was undertaken to solve the problems that occurred during the development of IEP. Each team member had a stake in his or her area of expertise. Each had a share in developing a good IEP, the IEP that matches the interests, needs, and abilities of students with disabilities.

Writing

The IEP writing format consists of student identity (name, gender, place of birth date, name of parent/guardian), name of school, class, program compiler which is the IEP development team, implementation team, assessment ever completed, special needs, specifically needed equipment, barriers and strengths (known from assessment), needs and treatment (adjusted for constraints and strengths), supporting and inhibiting factors (at school, at home, and elsewhere), long-term and short-term targets, and evaluations to be made.

The Chemistry IEP Product and Its Validation

IEP for Chemistry has been developed successfully based on Islam - science integration approach. This document consists of several learning tools, i.e. IEP form, syllabi, lesson plan, subject matter, assessment sheet and learning media. The following description will explain the modifications made to the preparation of the Chemistry IEP development for students with hearing impairment and the reason for the modification.

Excerpts of Syllabus

The information contained in syllabus excerpts is school identity, subject, class/semester, the standard of competency, basic competencies, learning material, learning activity, learning objectives(s), character education value, appraisal, time allocation, and source of materials and teaching aids. Standard of competency and basic competencies were not modified because it is mandated from national curriculum of 2006 that students have a minimum requirement to learn chemistry. In the adaptive curriculum development for inclusive school, however, it was possible to make any modification on a standard of competence and basic competencies (Rudiyati, 2010). As for the reason of

the absence of modifications in this study was, the researcher wants the students with hearing impairment to have the ability equivalent to their peers, so that the students with hearing impairment can follow the next learning materials and can follow to the next level well. The modifications made to the syllabus were learning activities, objectives, and time allocation.

Learning activities were modified in the form of the selection of learning methods deemed appropriate to regular students in general and students with hearing impairment, namely discussion, mind map, gallery learning, and jigsaw. The reason for the modification was that the student with hearing impairment has limitation in a hearing, lack of vocabulary, so the selection of varied methods was expected to increase students' interest to learn chemistry. Learning objectives were represented by differentiating objectives for regular students and students with hearing impairment. Prior to the assessment of the teacher, modification of the indicator was only done by changing the difficulty level. The time allocation was modified by adding 4 hours of learning for every 6 hours of learning. An explanation of this will be presented at the annual and semester programs session.

Annual and Semester Programs

The annual program consists of the name of semesters, the standard of competency, basic competencies, and time allocation, while the semester program consists of standard of competency, basic competencies, lesson hours, and weeks/months of learning. For this part, time allocation was modified. Per 4 hours of lessons for regular students, then given 2 hours' additional lessons for the student with hearing impairment, so the total hours of study for the student with hearing impairment were 6 hours of lessons. Additional hours of this lesson can be given the lesson in the form of remedial teaching, either at school or elsewhere or it could be in the form of private lessons. The reason of this modification was that student with a hearing impairment needs longer time to receive learning material regarding translating their language to Bahasa Indonesia. As known, sign language is their mother language and Bahasa Indonesia is the second one.

Adaptive Lesson Plan

It has been noted that an inclusive school, NS is welcoming students with disabilities to learn alongside their peers. The average number of students in one class is 34 students, with 33 students without disabilities and one student with special needs (student with hearing impairment or visual impairment). The adaptive lesson plan was developed according to the syllabus. Learning activities in details have been adapted from the syllabus into the adaptive lesson plan.

The method used was cooperative learning by using flash card media. This flash card can help students to quickly understand the content. Flash card was made based on daily activities undertaken by students. Evaluations were used, modified in the written evaluation section, by simplifying the questions given to students with hearing loss.

On the other hand, the modifications made to the preparation of Chemistry IEP development for students with visual impairment presented in the following explanation.

Excerpts of Syllabus

The modifications made to the syllabus were learning activities, indicators, and time allocation. Learning activities modified in the form of the selection of learning methods and learning resources were perceived in accordance with regular students in general and students with visual impairment. The discussion was used as a selected method and accompanied by audio learning resources in the .mp3 format. The reason for the modification was that students with visual impairment have less ability in terms of confidence and adaptation with their environment, and less able to adapt and associate with their environment so that this method was expected that students will have better self-confidence and adaptability. In addition, students can be more helpful with the many friends who accompany him. While in terms of learning resources, students were using media (in .mp3 format) of Atomic Theory that can be heard through mobile phone or laptop, and students can operate the tools well. In addition, this learning resource was also easy to carry so it can be used anytime.

Learning objectives were represented by differentiating objectives for regular students with students with visual impairment. The modification was done on the level of difficulty/cognitive level that must be mastered by students. In the regular students, the objectives that must be achieved is up to the Bloom cognitive level of "analyzing" (C4) while the students with visual impairment were only up to the "explaining" level (C2). The time allocation was modified by adding 4 hours of learning for every 6 hours of learning. An explanation of this will be presented on the part of the annual and the semester programs.

Annual and Semester Programs

For annual and semester programs, the modification was made in time allocation. Per 6 hours of lessons for regular students, then given 4 hours of additional lessons for students with visual impairment, so the total hours for students with disabilities are 10 hours of lesson. Additional hours of this lesson can be given the lesson in the form of remedial teaching, either at school or elsewhere or it could be in the form of private lessons.

Adaptive Lesson Plan

The adaptive lesson plan was developed according to the syllabi, specifically in the part of teaching and learning activities and adaptive media.

The Chemistry IEP Embedded with Islamic Contents and Values as the Final Product

The two examples of subject matters that embedded with Islamic content and values will briefly explain how the integration of Islam and the sciences incorporated into the Chemistry IEP.

The Chemistry IEP product

Periodic System of Elements

In the lesson plan, chemistry teacher can give a brief explanation as an apperception about the concept of the atom, that explained as “*dzarrah*” in the Qur'an.

وَمَا تَكُونُ فِي شَأْنٍ وَمَا تَتْلُو مِنْهُ مِنْ قُرْآنٍ وَلَا تَعْمَلُونَ مِنْ عَمَلٍ إِلَّا كُنَّا عَلَيْكُمْ شُهُودًا إِذْ تُبَيِّنُونَ فِيهِ ۚ وَمَا يَعْرُبُ عَنْ رَبِّكَ مَنْ
(61) مِثْقَالَ ذَرَّةٍ فِي الْأَرْضِ وَلَا فِي السَّمَاءِ وَلَا أَصْغَرَ مِنْ ذَلِكَ وَلَا أَكْبَرَ إِلَّا فِي كِتَابٍ مُبِينٍ

And, {Muhammad}, you are not {engaged} in any matter or recite any of the Qur'an and you {people} do not do any deed except that We are witness over you when you are involved in it. And not absent from your Lord is any {part} of an atom's weight within the earth or within the heaven or {anything} smaller than that or greater but that it is in a clear register. Q.S. Yunus: 61.

The word *Dzarrah* used by the Qur'an to point to something very tiny. Formerly *Dzarrah* is understood by the unconscious society as heads/eggs of ants or dust that are seen flying in the sunlight. Today, the word is defined as an atom. There is also a smaller part of *Dzarrah* referred to as the protons and neutrons. Protons and neutrons are the two components of the atom.

Before the Qur'an existed, a Greek philosopher from the Leukipos era named Demokritos declared his postulate, "matter consists of very small particles that are invisible and indivisible, the particles are called atoms." Thus, the atoms cannot be divided and are part Atom comes from the Greek word 'a' which means 'no' and 'tomos' which means 'divided'. Arabians have also known atomic terms long before Islam came the word 'atom' at that time was called *dzarrah*.

Reaction Rate

In the lesson plan, chemistry teacher can give an apperception about the concept of energy and material.

"When modern science has not developed, the most easily recognizable thing as a fast-paced thing (*dhabhan*) is a horse, so that '*adiyahat*' is often interpreted as "horse", although Arabians never mention the animal as '*adiyahat*'. It means that at first the universe was merely a form of energy. Then some energy undergoes transformation into a matter, according to Einstein's equation, in the form of particles and antiparticles (opposite charge with particles). These are the particles of *al-'adiyahat* that collide with the speed of darting (*dhabhan*), so that the sparks (*al-muriyat*) are heat and light, and scatter (*qad-han*)."

Using the two examples of apperceptions mentioned above, chemistry teacher can follow the teaching and learning process into the main stage. The integration between Islam and science in the learning activities depend heavily on teachers' creativity.

Experts' Assessment of the IEP

The experts involved in this study have given some suggestions for the IEP improvement, i.e.: material expert has given suggestions in regards of to be aware of developing material regarding to the concept's validity; media expert only focused on grammatical errors; and inclusive education expert said to be concern with the time allocation for additional time for students with disabilities. Chemistry teacher and teacher support offered their attention to the lesson plan and syllabi format and asked the researcher to change those documents as same as the school's format.

Chemistry Teacher and students with disabilities response to the IEP

Both chemistry teacher and students with disabilities have a positive response to this IEP. The teacher said using this document will help him to provide better support for students with disabilities. Another response is by offering the Islamic values in the learning process will be beneficial for all children (not only who with disabilities) to realize that chemistry is around us and very close to the daily life. As a teacher in inclusive school, he hoped he has an opportunity to get a special training to gain his knowledge in how adapt learning material and learning process properly for students with disabilities.

Students with disabilities were also very welcome with this document and they hoped teachers would use it in their daily learning activities, not just for research purposes. By providing IEP, they felt the teacher was more concerned about their learning needs. Integrating learning materials of chemistry and Islamic values was a new idea for students and made them more interested in learning chemistry.

Conclusion

Based on the findings and discussion, it can be concluded almost all the subject matter in chemistry can be integrated with Islamic values, including seeking support for the verses of the Qur'an and corresponding hadiths. In this study only developed two basic materials, namely Periodic System of Elements and Reaction Rate. The chemistry IEP model has been successfully developed for students with disabilities which integrate with Islamic values and Qur'anic verses through 3 stages of development, namely: assessment, collaboration, and writing. Chemistry teacher and students with disabilities responded positively to the IEP produced.

Suggestion

This developed Chemistry IEP is expected to be piloted to students with disabilities in order to know the constraints in implementing it, including the advantages that can be extracted through the implementation. It should also be socialized to other subject teachers in addition to chemistry, support teachers, school principals, staff and students with disabilities parents in order to be concerned about IEP development as a document to deliver students to the achievement of learning success.

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References

- Andriadi. (2013). *Manajemen Pendidikan Inklusi di MAN Maguwoharjo Depok Sleman Yogyakarta (translation: Inclusive Education Management in MAN Maguwoharjo Depok Sleman Yogyakarta)*. UIN Sunan Kalijaga, Yogyakarta.
- Petunjuk Teknis Penggunaan dan Pertanggung Jawaban Keuangan Dana Bantuan Operasional Sekolah (translation: Technical Guidelines on the Use and Accountability of School Operational Assistance Funds), (2014).
- Ausmus, D., Champion, K., McKay, C., Fewster, S., Neden, J., Phillips, J., & Simpson, R. (2009). *Individual Education Planning for Students with Special Needs: A Resource Guide for Teachers*. British Columbia: Ministry of Education.
- Auxter, D., & Pyfer, J. (2001). *Principles and Methods of Adapted Physical Education and Recreation* (9 ed.). New York: McGraw-Hill.
- Blanton, L. P., Pugach, M. C., & Florian, L. (2011). *Preparing General Education Teachers to Improve Outcomes for Students with Disabilities*. New York: National Center for Learning Disabilities.
- Bowlin, T. M. (2012). *Inclusion and Collaboration: Impact of Pre-service Teachers' Experiences on Their Knowledge, Attitudes and Perceived Sense of Efficacy*. Tennessee: University of Tennessee.
- Bruster, D. D. (2014). *COMPARING THE PERCEPTIONS OF INCLUSION BETWEEN GENERAL EDUCATION AND SPECIAL EDUCATION TEACHERS*. Liberty University, Virginia.
- Carrington, S., & Elkins, J. (2002). Bridging the gap between inclusive policy and inclusive culture in secondary schools. *Support for Learning. A Journal of the National Association for Special Educational Needs*, 17(2), 51-57.
- CAST. (2011). *Universal design for learning guidelines version 2.0*. Wakefield.
- Creswell, J. W. (2012). *Educational research : planning, conducting, and evaluating quantitative and qualitative research* (4th ed. ed.). Boston: Boston : Pearson.

- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches (4th ed.)*. Thousand Oaks, California: SAGE Publication.
- Denzin, N. K., & Lincoln, Y. (2003). *Collecting and interpreting qualitative materials (2nd Ed.)*. Thousand Oaks, California: Sage Publication.
- Fitriyani, S. N. (2012). *Aksesibilitas Pelaksanaan Praktikum Kimia Bagi Peserta Didik Tunanetra pada SMA/MA Inklusif Di DIY Tahun Ajaran 2011/2012 (Studi Kasus di MAN Maguwoharjo dan SMAN 1 Sewon)* (translation: *Accessibility of the Implementation of Chemistry Lab Work for Blind Students in Inclusive Senior High School In DIY Academic Year 2011/2012 (Case Study in MAN Maguwoharjo and SMAN 1 Sewon)*). UIN Sunan Kalijaga Yogyakarta, Yogyakarta.
- Foreman, P. (2001). *Integration and Inclusion in Action*. Victoria: McPhersons Printing Group.
- Forlin, C., Chambers, D., Loreman, T., Deppeler, J., & Sharma, U. (2013). *Inclusive Education for Students with Disability: A review of the best evidence in relation to theory and practice*. Retrieved from https://www.aracy.org.au/publications-resources/command/download_file/id/246/filename/Inclusive_education_for_students_with_disability_-_A_review_of_the_best_evidence_in_relation_to_theory_and_practice.pdf
- Gargiulo, R. M., & Metcalf, D. (2015). *Teaching in Today's Inclusive Classrooms, 3rd ed.* USA: Cengage Learning.
- Goldkuhl, G. (2012). Pragmatism vs interpretivism in qualitative information systems research. *European Journal of Information Systems, 21*, 135-146.
- Hanjarwati, A., & Aminah, S. (2014). Evaluasi Implementasi Kebijakan Pemerintah Kota Yogyakarta Mengenai Pendidikan Inklusi (translation: Evaluation of the Yogyakarta municipality Government Policy in Inclusive Education Implementation). *Journal of Disabilities Studies, 1*(2).
- Ikrom, A., Taufik, A., Hendri, A. F., Prayitno, H., Darmawan, R., Sudarno, R., & Rohani, S. (2015). *Peta Jalan Pendidikan 12 Tahun di Indonesia (translation: 12 Years Indonesia Education Road Map)*. In D. Koesoema (Series Ed.)
- Khayati, N. (2015). *Identifikasi Problematika yang Terjadi pada Proses Pembelajaran Kimia di Sekolah Inklusif (Studi Kasus Siswa Difable Rungu Wicara Di Kelas X SMA Muhammadiyah 4 Yogyakarta)*. Translation: *Identification of Problems in Chemistry Learning Process in Inclusive School (Case Study of Student with Hearing Impairment In Class X SMA Muhammadiyah 4 Yogyakarta)*. UIN Sunan Kalijaga, Yogyakarta.
- Kokaridas, D., Paslamouska, M., Patsiaouras, A., Natsis, P., Karagiannidis, I., Maggouritsa, G., & Efthimiou, P. (2014). Dynamic Evaluation Approach in Adapted Physical Education: Assessing Individualized Education Procedures for Inclusion Purposes. *Journal for Inclusive Education, 3*(2).
- Küpper, L. (2000). *A Guide to the Individualized Education Program*. Jessup: National Information Center for Children and Youth with Disabilities (NICHCY).
- Lundine, J., Hadikusumah, R. Y., & Sudrajat, T. (2013). Indonesia's progress on the 2015 Millennium Development Goals. *Strategic Review, 3*(3), 54-66.
- Mason, P. L. (2013). *Comparing Types of Student Placement and the Effect on Achievement for Students with Disabilities*. Liberty University, Lynchburg, Virginia.
- Merriam, S. B., & Tisdell, E. J. (2014). *Qualitative Research A Guide to Design and Implementation (4rd ed.)*. Hoboken: Wiley.
- Miner, D. L., Nieman, R., Swanson, A. B., & Woods, M. (2001). *Teaching Chemistry to Students with Disabilities: A Manual for High Schools, Colleges, and Graduate Programs* (K. Carpenter Ed. 4 ed.). USA: American Chemical Society Committee on Chemists with Disabilities.
- Morgan, D. L. (2014). Pragmatism as a Paradigm for Social Research. *Qualitative Inquiry, 20*(8), 1045-1053.
- Muhammad, H. (2015). Angka Partisipasi Bersekolah Anak Berkebutuhan Khusus Rendah. (translation: The Low Participation Rate in School Children with Special Needs)
- Murray, T. (2006). *Guidelines on the individual education plan process*. Dublin: National Council for Special Education.
- NCSE. (2013). *Supporting Students with Special Educational Needs in Schools*.
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: integrating theory and practice, 4th Ed.* Thousand Oaks, California: Sage Publications
- Punch, K. (2014a). *Introduction to research methods in education* (2nd edition. ed.): London : SAGE.
- Punch, K. (2014b). *Introduction to social research : quantitative and qualitative approaches* (Third edition. ed.): Los Angeles, California SAGE.
- Punch, K. (2014c). *Introduction to social research: quantitative and qualitative approaches (3rd ed.)*. Los Angeles, California: SAGE Publication.

- Rosyada, D. (2015). Integrasi Sains dan Agama Harus Dimulai dari Kurikulum (translation: Integration of Science and Religion Should Start from the Curriculum). Retrieved from <http://www.uinjkt.ac.id/index.php/category-table/2951-integrasi-sains-dan-agama-harus-dimulai-dari-kurikulum.html>. website:
- Rudiyati, S. (2010). Pengembangan dan Pengelolaan Program Pendidikan Individual bagi Anak Berkelainan di Sekolah Inklusif. (translation: the development of Individual Education Program for Children with Disabilities in Inclusive School) *Jurnal Pendidikan Khusus*, 6(1).
- Salend, S. J. (2005). *Creating Inclusive Classroom: effective and reflective practices for all students* (5 ed.). New Jersey: Pearson Education.
- Saputro, A. N. C. (2011). *Pengintegrasian Nilai-Nilai Relegius dalam Buku Pelajaran Kimia SMA/MA Sebagai Metode Alternatif Membentuk Karakter Insan Mulia pada Siswa* (translation: *Integrating Value of Religius In Secondary School Chemitry Learning Books as Alternative Methods in Forming Character of Noble Insan*). Paper presented at the Biologi, sains, lingkungan, dan pembelajarannya menuju pembangunan karakter, Pendidikan Biologi FKIP UNS.
- Satrio, B. Y. D. (2016). *Pengembangan Epub Modul Kimia Materi Pokok Larutan Elektrolit Dan Non Elektrolit Untuk Siswa Difabel Netra SMA/MA Kelas X* (translation: *The Development of Epub Chemistry Module (Electrolyte and Non-electrolyte) for Blind Students Grade X*). UIN Sunan Kalijaga, Yogyakarta.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22, 63-75.
- Suprihatiningrum, J., & Fitriyani, S. N. (2014). Studi Komparasi Modul Kimia Berbasis Media Screen Reader Jaws dan Braille terhadap Prestasi, Motivasi, dan Kemandirian Belajar Peserta Didik Difabel Netra (translation: Comparative Study of Chemistry Based Module Screen Reader Jaws and Braille on Achievement, Motivation, and Self-Reliance Learning for Students with Vision Impairment). *INKLUSI: Journal of Disability Studies*, 1(2), 207-219.
- Umiyati, L. (2013). *Ketersediaan Media Pembelajaran Kimia bagi Peserta Didik Difabel Netra di SMA N 1 Sewon Bantul dan MAN Maguwoharjo Sleman Tahun Pelajaran 2012/2013* (translation: *Availability Media Learning Chemistry for Students with Disabilities in SMA N 1 Sewon Bantul and MAN Maguwoharjo in Academic Year 2012/2013*). UIN Sunan Kalijaga, Yogyakarta.
- Yeager, E. G. (2014). *Difference in science achievement for students with learning disabilities taught in small group versus inclusion setting*. Georgia College and State University.
- Yin, R. K. (2014). *Case study research: Design and methods* (5th Ed.). Thousand Oaks, CA: Sage Publications.