The Profile of Generic Science Skills of Pre-Service Elementary School Teacher Education of Riau University

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Abstract: The purpose of this research was tofind out the profile of Generic Science Skills of Pre-Service Elementary School Teacher Education with the level of comparison and the development of generic science skills ofearly-year students,middle-year students, and final-year students. The subject of this research wasthe students of Elementary School Teacher Education Study Program consisted of 80 students that have been taken by using*Stratified Sampling* technique in the academic year of 2011 to 2014. The resultsof the profile of generic Science skills of Pre-Service Elementary School Teacher Educationbased on level/ academic yearshowed that the *Logical Frame* skill and *cause-effect law* skill have increased yearly.Then, the *Indirect Observation*skill and the *awareness of scale* skill have decreased. While, other skills have change dimpermanently.The changes of Generic science skills on every level of studentswere caused by some factors either internal or external factors.

Keywords: *Profile, Generic Science Skills*

I. Introduction

Every student gets a variety of knowledge. One of them is knowledge about science. It is the concept of natural learning, and has a broad relationship with human life.Science subjectplays a very important role in the education process and technological development (Husada et al, 2014). This subject leads students to understand, discover, and explain the concepts and principles of science through discovery process without emphasizing on memorization.

BSNP (2006) states that science is expected to be a vehicle for students to learn themselves,natural surroundings, and the prospect for further development in applying it in their daily lives. The learning process undertaken by the students must be followed by the development of various skills, especially Generic Science Skills. The main reason of the importance of its development is because the Generic Skills are categorized into basic and general skills, flexibility,and oriented as provision for learning higher science, or to serve broader fields of works, and is not only according to area of expertise, but also in other fields. (Bailey, 2001).In addition, Brotosiswojo (2000) also confirms that the generic science skill is very important in building personality and mindset of Indonesian people becauseGeneric Science skills are asa basis for creative thinking and creative processes, and to make decisions and problem solving in everyday life (Costa, 1985).

The Generic skills arethe combination of various abilities; cognitive, affective, and psychomotor, which can be provided to each student.These skills willdevelop in someone if he/she is trained continuously.Besides, the Generic skill is also a basis to develop other skills, including cognitive, personal, and interpersonal. Therefore, Generic Science skillcan be applied to all types of science, and are very useful in solving various problems.

In some developed countries, the Generic Skills have been classified.For instance, in England, the Generic Skillsare divided into two big groups;basic science skill and broader key skill. Moreover, in Canada,the Generic skillshave been classified into three big groups;basic science skill, self-management skill, and teamwork skill. These skills arethe skills to work (NCVER, 2003 in Tawil andLiliasari, 2014). The Australian Industry Group also classifiesthem into three groups;basic generic skill, interpersonal skill, and personal attributes (Curtis andDempton, 2003). Yet, these differences do not cause problems because the Generic skills become increasingly important and very vital for all aspects of human life.

The Generic Science Skills have 9 indicators, namely: (1) direct and indirect observation, (2) awareness of the scale, (3) the symbolic language, (4) *Logical Frame* skill, (5) logical inference, (6) cause-effect law, (7) mathematical modeling, (8) building concept (Brotosiswoyo, 2000), and (9) space view/ abstraction (Sudarmin, 2007). These indicators are the guidelines to determine the extent to which a person's generic skill development, particularly students. According to Dearing, R. (1997),the ability of the Generic Skills of university studentsis focusing on using technologicalskill, communication, numerical, andlearning skill. Therefore, the Generic Science skills are very importantto be possessed and mastered by the students in preparing learning process, adapting to the natural and social environment, and help them in the work they want after graduating from university.

Many research results related to Generic skills have been carried out, for example,Hipkins (2006), who suggests the development of Generic skills carried out through self-reflection. Saptorini (2008), who said that the application of the chemistry practicum analysis method of inquiry-based instrument analysis could improve the mastery of Generic science skills of chemistry teacher candidates.Furthermore, Sudarmin (2009), who said that the application of the Generic Science skills integrated chemistry learning model was able to (1) improve the thinking skills of chemistry teacher candidates, (2) improve the mastery of students' chemical concepts, and (3) obtain positive responses from students, and can invite students to be actively involved during learning, providing guidance services, and increasing concepts. Ling and Bridgeman (2011), who show titration practicums in basic chemistry lectures can increase student Generic Science skills. Finally, Agustinaningsih, et al. (2014), who explained that the development of Generic Science skill-based practicum instructions can produce valid and practical products to be used by students in learning, and can improve students' cognitive learning outcomes.

From the explanation above, it proves that the Generic Science skills are very important for Pre-service Elementary School Teacher. Hence, it wasnecessary to conduct a research in order to find out the condition or profile of generic Science skills of pre-service elementary school teacher education beforethey graduate and get a bachelor's degree.

2. Methodhology

This research was descriptive research. It aimed at describing and interpreting the exist phenomenon, which takes place at present or in the past. This research is also known as non-experimental research.According to Furchan (2004), descriptive research has some characteristics. It can be seen as follows:

1. Descriptive research tends to describe a phenomenon as it is by reviewing it regularly, prioritizing objectivity, and being done carefully.
2. The absence of treatment given or controlled, and absence of test h.

Sukardi (2008) pointed out that the main purpose of descriptive research is to describe the facts systematically,and researching the characteristic of subject and object of research appropriately. In this research, the writer used questionnaire and interview.

The population of this research was the Pre-service Elementary School Teacher Education study program, Faculty of Education and Teachers Training of Riau University consisted of 500 students.The samples of this research were80 students. The samples were taken by using *Stratified Sampling*technique.

3. Result and Discussion

The result of this research was analyzed based on the level of academic years, started from 2011 (final-year students), 2012, 2013, and 2014. The researcher gave questionnaires to all samples consisted of 50 items/statementsabout students' Generic Science Skills. The final-year students, generally, ranging from the fourth to eighth semester who were in thesis exam preparation.The students' Generic Science skills can be seen in the following table.

Tabel 1.The description of the profileof Generic Science skills of Pre-service Elementary School Teacher Educationbased on the level/ academic years.

Skill Type	**Average of Students' Response**							
	Academic Year 2014 (Level I)		**Academic Year 2013 (Level II)**		**Academic Year 2012 (Level III)**		**Academic Year 2011 (Level IV)**	
	Positive (%)	**Negative (%)**	**Positive (%)**	**Negative (%)**	**Positive (%)**	**Negative (%)**	**Positive (%)**	**Negative (%)**
Direct Observation	**85,71**	**14,29**	**85,71**	**14,29**	**88,57**	**11,43**	**85,71**	**14,29**
Indirect Observation	**70,83**	**29,17**	**68,33**	**31,67**	**66,67**	**33,33**	**66**	**34**
Awareness of scale	**100**	**0**	**100**	**0**	**95**	**5**	**92,5**	**7,5**
Symbolic Language	**91,25**	**8,75**	**91,88**	**8,12**	**86,88**	**13,12**	**91,88**	**8,12**
(*Logical Frame*)	**80**	**20**	**87,5**	**12,5**	**90**	**10**	**95**	**5**
Logical consistency	**85**	**15**	**89,38**	**10,62**	**83,75**	**16,25**	**90**	**10**

Cause-effect law	**88**	**12**	**91**	**9**	**90**	**10**	**94**	**6**
Mathematical Modelling	**75,83**	**24,17**	**83,33**	**16,67**	**84,17**	**15,83**	**83,33**	**16,67**
Concept Building	**100**	**0**	**95**	**5**	**100**	**0**	**95**	**5**
Abstraction	**91,25**	**8,75**	**85**	**15**	**95**	**5**	**86,25**	**13,75**

From the table above, it shows that the highest positive responseor the condition of generic science skills in the academic year of 2014is the awareness of scale skill and the concept building skillwith percentageat 100%. Yet, for indirect observation, it isonly 70,83%. So, it needs improvement.

The most important indicator of indirect observation skills to be developed is an indicator of using a measuring instrument as a sensory aid in observing experiments / natural phenomena, and for looking for differences and similarities. These two indicators have the highest number of negative responses, at 55% and 100%. Other indicators that still need to be developed are the Arguing based on rules indicator, this indicator is on Logical Consistency skills with a number of negative responses of 55% and a Revealing phenomenon indicator, which is in the Mathematical Modeling skill, with the number of responses negative by 50%. Overall, it can be concluded that the students' generic science skills in the academic year of 2011 are in the upper middle condition (conversion 0-100%).

The description of students' generic science skills in the academic year of 2013 can be concluded thatthe highest percentage is the Concept building skill and the awareness of scale skill, which are in the order of 95% and 100%. Whereas for Indirect Observation skills obtained positive responses or conditions of students' generic science skills at 68.33%, which means that there is a need for development.

The main important Indirect Observation skill indicator to be developed is the indicator of looking for differences and similarities. It has the highest number of Negative responses, which is 100%. Another indicator that still needs to be developed is the Arguing based on rules indicator, this indicator is on Logical Consistency skills, with a Negative response number of 65%. Overall, it can be concluded that students' generic science skills in the academic year of 2013 are in the upper middle condition (conversion 0-100%).

The description of the 2012 generic science students' skills can be concluded that the Positive responses or the highest percentage of generic science skills are Skills of Scale Awareness, Abstraction skills, and Concept Building skills, that areat 95%, 95 %, and 100%. Whereas, for Indirect Observation Skills, the Positive responses or conditions of student's generic science skills are at 66.67%, which means that there is a need for development.

Moreover, the most important Indirect Observation skill indicator to be developed is an indicator of "looking for differences and similarities". It has the highest number of Negative responses, which is 100%. All in all, it can be concluded that the generic science skills of the 2012 students are in the upper middle condition (conversion 0-100%).

The description of the generic science skills of the 2011 students (final year students) can be concluded that the Positive responses or conditions of the generic science skills that have the highest percentage are Logic Frame Skills and Concept Building Skills, which is 95%. Whereas, for Indirect Observation Skills, the positive responses or conditions of student's generic science skills are 66%, which means they still need to be developed.
The most important indicator of indirect observation skillsthat needs to be developed is an indicator of using a measuring instrument as a sensory aid in observing experiments / natural phenomena, and for looking for differences and similarities. These two indicators have the highest number of Negative responses, which are 65% and 95%. Another indicator that still needs to be developed is the Arguing based on rules indicator, it is in Logical Consistency"skills, with a Negative response amount of 55%. Overall, it can be concluded that the generic science skills of the 2011 students are in the upper middle condition (conversion 0-100%).

Brotosiswoyo (2000) says that there are 9 generic science skills: 1. Direct observation, 2. Indirect observation, 3. Awareness of scale, 4. Symbolic language, 5. Logical frame 6. Logical Inference, 7.Cause-effect law, 8.Mathematical modelling, 9.The concept building, and added or completed bySudarmin (2007), that is10. Abstraction.

These skills have different variations in each level of students. The results showed that the generic science skills that have increased in each level of students (starting from level I to level IV) were the skills of Logical Frames and the Law of Cause and Effect skill. The increasing ofLogical Frame skill due to teaching-learning process conducted at Elementary School TeacherEducation is able to train students' in thinking logically and solving various problems in elementary school, especially for science courses. The teaching-learning held at Elementary School TeacherEducation vary widely, for example, the use of cooperative learning, laboratory inquiry learning, the use of interactive media, and various other types of learning strategies. Ferawati (2011) and Sutarno (2011) explain the results of their research that the use of interactive multimedia learning models to improve the Logical Frames skill. The use of various learning strategies in lectures is also able to improve various skills.

The increasing of generic science skills at each level of students (starting from level I to level IV) are the skills of Logical Frame and the skills of Law of Cause and Effect. It is due to the teaching-learning process conducted at elementary school teacher education is able to train students to think logically in solving various problems, especially for science courses. It is held at elementary school teacher education vary widely, for example, the use of cooperative learning, laboratory inquiry learning, the use of interactive media, and various other types of learning strategies. Ferawati (2011) and Sutarno (2011) explain the results of their research that the use of interactive multimedia learning models can improve the skills of Logical Frames. The use of various learning strategies in the teaching-learning process is also able to improve various skills.

The improvement of Cause and Effect skills are caused by the development of thinking skills of students who have found out about the relationship between two or more variables in a natural phenomenon, seeking the truth and the causes of natural phenomena and various other natural phenomena. The deep curiosity of students is formed due to the science learning they get from level I to level IV, besides the existence of research methodology courses, PPL (teaching practice on campus and school), and the making of the final project (thesis) requires them to know the causes the occurrence of symptoms and natural phenomena, as their provision in providing answers to students, teachers, and the community.

Hartono (2005) says that the Cause and Effect Law skill relates to connecting two or more laws, theories, and principles with a natural phenomenon that is still at the level of basic thinking skills. Therefore, the higher the level of college students, it is hoped that in general the skills of "Law of Cause and Effect" of students will also increase. Liliasari (2008) also explained that the Law of Cause and Effect skill is very suitable for types of concepts that are abstract, principle, and process.

The skills that have the biggest decreased are Indirect Observation skill and Scale Awareness skill. These two skills occurred when students entered level 4, this was due to the lack of student involvement in the laboratory because students had focused on completing the final project (thesis). The final project of students is more oriented to improving the quality of learning in elementary school by using only a variety of strategies, models, approaches, methods, and learning media, so that they rarely use laboratories.

The lack of student involvement in the laboratory is also supported by the availability of laboratory equipment in the schools where they teach, study, thus indirectly impacting the low skills of Indirect Observation and Scale Awareness skills. Sudarmin (2007) explained that the science was developed based on experiments, therefore, science teachers were required to have a generic science capacity of awareness of high scale. One effort that can be done is to direct student research into the use of laboratories, such as using laboratory inquiry-based learning. Saptorini (2008) also asserts that the skill of indirect observation and awareness of scale is very important especially related to scientific work.

Other skills such as direct observation, symbolic language, logical consistency / logical inference, mathematical modeling, constructing concepts, and space insight / abstraction, generally, do not haveany development. This is because students entering elementary school teacher education are groups of students who have passed the college admission selection. Based on data from the University of Riau, elementary school teacher education is the highest study program, which has an impact on the strictness of student admission. The tight selection of student admissions can be indicated as a high quality of input, so that directly the various skills that exist within students have developed before entering the study program. The skills that exist in students will develop or not develop at all based on many factors, including the active role of students, the creativity of lecturers, and the college system. Sallis (2010) explained that educational institutions have an obligation to make students aware of the variety of learning given to them. Educational institutions must collaborate with lecturers and students in setting their goals, so the creation of a series of feedback that occurs continuously is a factor in the formation of educational quality assurance

4. Conclusion

a. Research Findings

From the result stated above in order to find out the profile of Generic Science Skills of Pre-service Elementary School Teacher Education of Riau University, itcan be concluded that:

1. The Generic Science Skills of Pre-service Elementary School Teacher Education,which has increased at every level of students (level I-IV) are*Logical Frame skill and*Cause-Effect Law skill. There is an improvement of *Logical Frameskill.*

2. The Generic Science Skills of Pre-service Elementary School Teacher Educationthat has decreased are indirect observation skilland awareness of scale skill. These skills have the biggest decreased

3. Other Generic Science Skills of Pre-service Elementary School Teacher Educationare direct observation, symbolic language, logical inference, mathematical modelling, concept building, and space view/ abstraction with no improvement.

From the explanation above, it is clear that, overall, the Generic Science Skills of Pre-service Elementary School Teacher Education still in upper middle condition.(Conversion 0-100%).

a. Suggestions

Based on the result of the research findings above, the researcher proposes some suggestions as follows:

1. The Generic Science Skills of Pre-service Elementary School Teacher Educationis recommended for students who has the Basic Skill. So, the students can practice and develop their skills.
2. The profile of the Generic Science Skills of Pre-service Elementary School Teacher Educationis also recommended for lecturers to designteaching-planning, teaching-learningor accreditation.
3. The profile of the Generic Science Skills of Pre-service Elementary School Teacher Educationis still measured by students' response, so it is recommended to use other instruments such as test and observation sheet.
4. The profile of the Generic Science Skills of Pre-service Elementary School Teacher Educationcan be tested and compared to other skills at different institutions.

References

Agustinaningsih, W., Sarwanto, danSuparmi.(2014). PengembanganInstruksiPraktikumBerbasisKeterampilanGenerikSainspadaPembelajaran FisikaMateriTeoriKinetik Gas Kelas XI IPA SMA Negeri 8 Surakarta TahunAjaran 2012/2013.*JurnalInkuiri*. **3 (**I), 50-61.

Bailey, P.T. (2001). Teaching Chemist to Communicate? Not my job. *Journal of Chemical Education*. 2001.580. [online] tersedia: http // www. uea.uk/che /ppds .[14 Juni 2004].

Brotosiswojo, B.S. (2000). HakekatPembelajaranFisika di PerguruanTinggi.Dalam Tim PenulisPekertiBidang MIPA (Eds), *HakekatPembelajaran MIPA &KiatPembelajaranFisika di PerguruanTinggi*. Jakarta: ProyekPengembanganUniversitas Terbuka. Depdiknas.

BSNP.(2006). *Standar Isi untukSatuanPendidikanDasardanMenengah*. Jakarta: BadanStandarNosionalPendidikan.

Costa, A.L. (1985).*Developing Mind: A Resource Teaching Thinking*.Washington D.C. ASCD.

Curtis, D. &Dempton, R. (2003).*The Authentic Performance-based Assessment of Problem-Solving*. King William Road: NCVER.

Dearing, R. (1997). *The Summary Report of The National Comitte of Inquiry IntoHigher Education*. London: HMSO.

Ferawati.(2011). Model Pembelajaran Multimedia InteraktifuntukMeningkatkanPenguasaanKonsepdanKeterampilanGenerikSains Guru FisikapadaTopikFluidaDinamis.*ProsedingPenelitianBidangIlmuEksakta 2011*.

Furchan, A. (2004). *PengantarPenelitiandalamPendidikan*. Yogyakarta: PustakaPelajar Offset.

Haladyna, T.M. (1997). *Writing Test Item to Evaluate Higher Order Thinking*. Boston: Allyn and Bacon.

Hartono.(2005). PembelajaranFisikaModerenBerorientasiKemampuanGenerik.*Disertasi*Pendidikan IPA. Program Pascasarjana-SekolahPascasarjana UPI-Bandung.

Hipkins, R. (2006). *The Nature of the Key Competencies*. Wellington: Ó NZCER.

Husada, S.A., Nuriman.,danMutrofin. (2014). PeningkatanAktivitasdanHasilBelajarSiswaKelas IV-A SDN Patrang 01 Jemberpada Mata Pelajaran IPA PokokBahasan Gaya melaluiMetodePembelajaranKooperatifTipe Think Pair and Share (TPS). Tersedia: http://repository.unej.ac.id/bitstream/handle/123456789/56356/Sinta%20Ambar%20Husada%20-%20100210204169_1.pdf%3%20Fsequence=1. [19 Juni 2015].

Liliasari.(2008). "PeningkatanKualitasPendidikan Kimia dariPemahamanKonsep Kimia menjadiBerpikir Kimia".[Online].Tersedia: http://www.google.co.id/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCQQFjAB&url=http%3A%2F%2Ffile.upi.edu%2FDirektori%2FSPS%2FPRODI.PENDIDIKAN_IPA%2F194909271978032-LILIASARI%2FMAKALAH_UNY_08. pdf&ei=2B6bVfinGYKdugSOio6gAg&usg=AFQjCNG-smcvFfavVRUs4zEQyyVLlFy0Qw&sig2=VMMUbOGsDDjiRHU9XFHSqQ&bvm=bv.96952980,d.c2E. [7 juli 2015].

Ling, C. D. dan Bridgeman, A. J. (2011). "Quantitative Analysis in the General Chemistry Laboratory: Training Students ToAnalyze Individual Results in the Context of Collective Data". *Journal of Chemical Education.***88**, (7), 979–982.

Sallis, E. (2010). *Total Quality Management in Education*. Jogjakarta: IRCiSoD.

Saptorini.(2008). Peningkatanketerampilangeneriksainsbagimahasiswamelaluiperkuliahanpraktikumkimia analisis instrument berbasisinkuiri.*InovasiPendidikan Kimia*. **2 (**1), 190-198.

Sudarmin.(2009). MeningkatkanKemampuanBerpikirMahasiswamelaluiPembelajaran Kimia TerintegrasiKemampuanGenerikSains.*Prosiding Seminar NasionalPenelitian, PendidikandanPenerapan MIPA*, Fakultas MIPA, UniversitasNegeri Yogyakarta, 16 Mei 2009.

Sudarmin, (2007).Pengembangan Model Pembelajaran Kimia OrganikdanKeterampilanGenerikSainsBagiCalon Guru Kimia.*Disertasi*Pendidikan IPA. Program Pascasarjana-SekolahPascasarjana UPI-Bandung.

Sukardi.(2008). MetodologiPenelitianPendidikan (KompetensidanPraktiknya). Jakarta: BumiAksara.

Sutarno.(2011). Penggunaan Multimedia InteraktifpadaPembelajaran Medan Magnet untukMeningkatkanKeterampilanGenerikSainsMahasiswa.*Jurnal Exacta*. **IX** (1).

TawildanLiliasari.(2014). *Keterampilan-KeterampilanSainsdanImplementasinyadalamPembelajaran IPA*.Makasar: UNM.