THE IMPLEMENTATION OF THE SCIENTIFIC APPROACH THROUGH 5MS OF THE REVISED CURRICULUM 2013 IN INDONESIA

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Abstract. In 2013, the Indonesian government implemented a new curriculum, namely Curriculum 2013 (C-13). The C-13 applies scientific approach in the learning process. This research aimed at depicting teachers performance in implementing the scientific approach with 5Ms in schools, including observing (*Mengamati*), questioning (*Menanya*), experimenting (*Mencoba*), Reasoning (*Menalar*), and communicating the results (*Mengomunikasikan*). This survey research was conducted in the years of 2013-2015 in eight senior high schools, involving 8 principals/vice principals, 16 biology teachers, and 80 students, and in 100 observable lessons. The data in this study were collected using a questionnaire, interview and observation. The data were subsequently analysed with descriptive quantitative. The results indicate that the teachers strived in implementing the scientific approach through 5Ms. The percentage of teachers who were good category in conducting the scientific approach was as follows: (1) Observing (M1) was 22.7%, (2) Asking questions (M2) was 27.8%, (3) Doing experiments (M3) was 23.9%, (4) Reasoning (M4) was 7.9%, and (5) Communicating (M5) was 18%. Therefore, it was concluded that the teachers still needed more training in conducting the scientific process through 5Ms in the implementation of the revised curriculum.

Keyword: ***curriculum 2013, curriculum implementation, scientific approach, 5M***

IMPLEMENTASI PENDEKATAN SAINTIFIK LEWAT TEKNIK 5M DALAM KURIKULUM 2013 EDISI REVISI DI INDONESIA

Abstrak. Pada tahun 2013 Pemerintah Indonesia menerapkan kurikulum baru, yaitu Kurikulum 2013 (K-13). K-13 menerapkan Pendekatan Saintifik dengan 5M dalam pembelajaran. Penelitian ini bertujuan untuk mengetahui kinerja guru dalam penerapan Pendekatan Saintifik melalui 5M di sekolah, meliputi kegiatan Mengamati (M1), Menanya (M2), Mencoba (M3), Menalar (M4), dan Mengomunikasikan (M5). Penelitian ini merupakan penelitian survei yang dilakukan pada delapan SMA yang menerapkan K-13, melibatkan 8 Kepala Sekolah/Wakil Kepala Sekolah urusan kurikulum, 18 orang guru Biologi, dan 80 siswa yang belajar biologi dengan K-13, pada 100 pelajaran. Data dikumpulkan lewat angket, wawancara, dan pengamatan, sedang analisis data dilakukan dengan teknik deskriptif kuantitatif. Hasil penelitian menunjukkan bahwa kinerja guru dalam menerapkan pendekatan saintifik 5M belum optimal. Persentase guru yang memiliki kinerja dalam kategori baik adalah sebagai berikut (1) Mengamati 22.7%, (2) Menanya 27.8%, (3) Mencoba 23.9%, (4) Menalar 7.9%, dan M5 (Mengomunikasikan) 18.9 %. Secara berangsur kesulitan tersebut menurun sejalan dengan waktu. Dengan demikian dapat disimpulkan bahwa para guru masih membutuhkan pelatihan K13 khususnya pada Pendekatan Saintifik 5M.

Kata Kunci: ***kurikulum 2013, implementasi kurikulum, pendekatan saintifik, 5M***

INTRODUCTION

Background

Curriculum implementation is one of the most crucial problems in the curriculum cycle (Aytan, 2016; Alshammari, 2013; Riley, 2013; Li, Yan, & Yu, 2014; Aktan, 2015); but unfortunately it affects students' the learning outcomes(Watlington, 2008). Starting from the year of 2013, Indonesian government implemented a new curriculum, namely Curriculum of 2013 (C13) in some assigned schools. There were about six assigned schools in every regency, for every level (primary, junior secondary, and senior secondary schools), for

about 514 regencies in Indonesia (MoE-aa, 2013). There were some supporting systems on the implementation of the curriculum. First, prior to the implementation, there were some cascading trainings for teachers and the principals on the new curriculum. Then, in the implementation of the curriculum, the teachers were also assisted and guided by a trained teacher (MoE-c, 2013). The other was monitoring and evaluation processes during the implementation to ensure that the implementation of the curriculum was on the right tracks. Besides, teacher and student books and syllabi were also provided. Therefore, the implementation of the curriculum should work well because of the supports.

The C13 had many changes that were not easy for teachers to implement them at the same time. First, it was a changing in the curriculum goals. The C13 curricular goal was to develop productive, creative, innovative, and affective Indonesians through nurturing their attitudes, skills, and knowledge in integrated ways (MoE-k, 2013). The goals of the C13 were organized in four Core Competences: (1) Spiritual Competence, (2) Social Competences, (3) Knowledge Competence, and (4) Skill Competences (MoE-k, 2013). Those core competences were described more detail in Basic Competences. The structure of the C13 was organized in four components: (1) basic structure, (2) structure, (3) syllabi, and (4) subject guide. The basic structure of the curriculum stated that there were two groups of subjects, namely group A and B for primary and secondary junior high schools. Group A was designed to develop students' knowledge, skills, and attitudes for living in the context of society, community, and country. The Group A had seven subjects A: (1) Religion and manner, (2) Ideology and civic education, (3) Indonesian language, (4) Mathematics, (5) Natural science, (6) Social science, and (7) English language (MoE-k, 2013).

Group B was designed to develop students' knowledge, skills, and attitudes for social interaction, culture, and arts. There were three main subjects of group B: (1) Art and culture, (2) Sport, physic and health, and (3) Handcraft. For some schools, such schools related to a religion, might add some subjects related to their specific contents to the curriculum. In addition, there was Group C which also called preference subjects chosen by students, consisting four groups: (1) Mathematics and science, (2) Social science, (3) Language and culture (MoE-k, 2013). In the new curriculum, students should learn 42-48 hours per week.

The C13 promoted a scientific approach in teaching and learning process through 5 Ms. The teaching and learning process applied 5Ms, extanding for (1) Mengamati (observing), (2) Menanya (asking questions), (3) Mengumpulkan informasi (information gathering), (4) Menalar (reasoning or data analyzing), and (5) Mengomunikasikan (Communicating) (MoE-aa, 2013) (MoE-c, 2013). Some schools may add two more Ms, that are (6) Mencipta (creating), and (7) Membuat jejaring (networking) (Depdikbud, 2014).

In C13, it is imperative that students are actively participate in their own learning through 5Ms. Students are required to do observation to identify a problem(s), to do background research by reading books, by interviewing people, or by browsing internet. Students construct hypotheses and testing hypothesis by doing an experiment or exploration. Students then analyze data and construct meaning. Finally students communicate the results by oral presentation or in written forms(MoE-c, 2013). In addition, teachers may also use other teaching and learning models, such as inquiry and discovery Learning model, Problem-based Learning, or Project-Based Learning model in the teaching and learning process(MoE-c, 2013).

In order to implement the curriculum, teachers had to develop learning materials consisting a lesson plan, a student worksheet, instrument of evaluation, and instructional media (MoE-aa, 2013). Learning materials are important because they are useful to guide instruction (Craft & Bland, 2004; Ediger, 2004). Some teachers used learning materials developed by subject teacher association (MGMP) or from friends.

The success of a curriculum implementation is affected by several factors (Alsubaie, 2016; Aktan,) Alshammari, 2013; Riley, 2013; Yeung, S., Lam, J., Leung, A., 2012). First, it should be assessed and measured both quantitatively and qualitatively. Monitoring and evaluating the implementation of the curriculum are necessary to ensure that the new curriculum is well-implemented. The implementation of curriculum should be assessed periodically

(Chandler, 2001) from many perspectives (Castaneda, et al., 2011), to make students are actively involved in the learning process (Kostuch, 2008). Therefore, study of the new curriculum implementation is imperative to do (O'Donnell, Carol L, 2008). This research tries to assessed the implementation of the scientific approach consisting 5 Ms in junior high schools.

Formulation of the problem

It is assumed that the more complex changes on a curriculum, the more difficult for teacher and students to understand and to implement it. Since the C13 had many changes, the teachers and students might have many difficulties. Therefore, this research focused on the ability of the teacher in implementing the scientific approach in teaching and learning process through 5Ms. The main question is whether senior high school teachers are able to implement the scientific approach in the teaching and learning process through 5Ms.

METHOD

Design

The design of the research was a survey, to depict the ability of the teachers in conducting the scientific approach through 5Ms in the implementation of the C13. The research was conducted during monitoring and assisting the schools from 2013-2015. The data were taken on from eight pilot schools in Yogyakarta district.

Subject of the research

The subjects of this research included (1) 8 senior high school principals/vice principals for curriculum affairs, (3) 16 biology teachers, and (4) 80 students. The observers were 8 trained students who were having teaching practice in the schools.

Data collection

The data were collected through three ways: survey, interview, and observation. The survey used questionnaires with politomous options. The instruments were sent to the respondents a week prior to surveyor coming. The respondents filled the instrument and the surveyor then checked the validity in term of the concordance of the respond to the real condition in schools by making discussion with the respondents. To get information about learning process, surveyors sit in the classroom for one period of lesson for each teacher and record the teaching-learning process. To get information about the existence of students and teacher books and also teacher training, the surveyor made an interview with school principals and vice principals for curriculum assessment the surveyor used document.

Instrument

The instrument of the research was questionnaires, an interview guideline, and observation checklists. An interview guide was used to interview participants to get more information from the principles/vice principals, teachers and students related to the implementation of the C13. A check list with observation notes was used to observe the teaching and learning process in the classroom.

Data analysis technique

Data analyses were mainly using descriptive quantitative methods. Data from interviews with principals and vice principals were analyzed descriptively concerning the number of teachers that have training on the C13, the number of assistant teachers, the readiness of the books, etc. From this data the researcher tried to ask question concerning the implementation of 5Ms. The data from the questionnaires and interviews were analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Results

The implementation of scientific approach through 5Ms

The C13 promotes scientific approach that consists of 5Ms. The data showed that good category in the implementation of M1, M2, M3, and M4 was 20%, 15%, 17%, 13%, and 15%. Teacher still had difficulties in implementing M1, M2, M3, and M4 was 23%, 33%, 21%, 40%, and 34% (Figure 1).

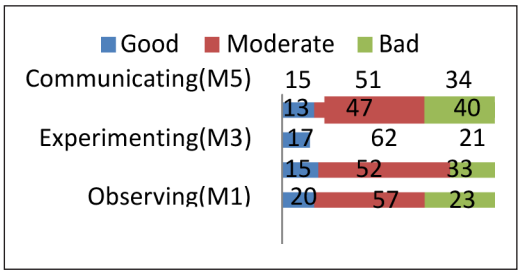

Figure 1. The percentage of teachers quality implementing 5Ms.

The implementation of M1

The M1 or Observing was an activity to observe a phenomenon (phenomena). Students used their five senses to observe the phenomenon. In order to enable students to do the observation, the teacher should present a phenomenon or phenomena. In science class, the phenomenon should meet three criteria: (1) natural, (2) problematic, and (3) realistic to be observed by the students. Here the results from 100 classes observed on the ability of the teachers in implementing the M1 (Figure 2).

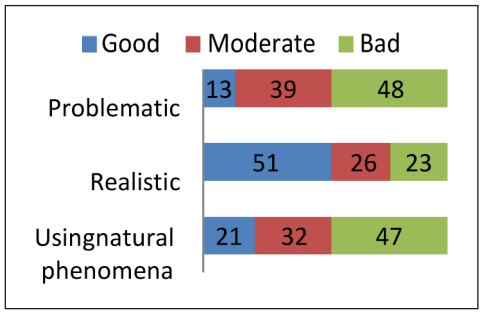

Figure 2. The percentage of teachers and their ability implementing M1.

Figure 1 showed that most of the teachers were able to use a natural phenomenon (21% good, 32% moderate, and 47% bad). For a good example, the teacher asked students to present body movements, then she asked students to observe what joints working on that movements. Many teachers just showed the picture on PowerPoint presentations. The phenomena the teachers present mostly realistic, they exist in real life contexts (51.5 was good, 26% was moderate, and 23% was bad). However, the phenomena the teachers present are not problematic (13% was bad, 39% was moderate, and 48% was good). Teacher ability in exposing a problematic phenomenon still needed improvement.

The M2 was questioning, where students asked questions to know more about the phenomenon they observe. Students might ask W questions, such as what, where, and when. They might also asked WH questions, such as why and how. The best question was a hypothetic question such as an "if.... then..." formula. The result of the asking question is presented bellow (Figure 3).

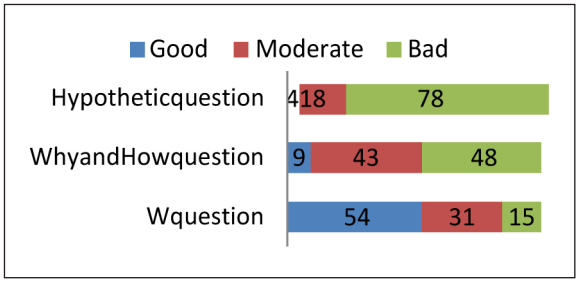

Figure 3. The percentage of teachers that promote students to ask questions

Figure 3 indicated that students mostly asked questions in W type (54% good), low in WH and Hypothetic questions (only 4% and 9% were good). Only 4% of the students asked questions of "Why" and "How", and only 9% of students asked hypothetic questions. In this case, higher order thinking skills yet were not developed from the lessons.

The M3 was an activity to collect information. In science class students may do an experiment or do a field exploration to get data. The M3 consisted of three levels: design experiments, doing experiments, and seeking information (from internet or books). The result was shown in Figure 4.

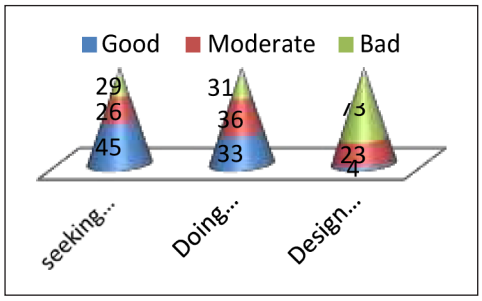

Figure 4. The percentage of teachers that promote students in seeking information (M3)

The M4 was also the ability of the teacher to promote students activity in organizing data, making table forms, and using simple statistics.

The measuring activity was good (33%), moderate (36%), and bad (31%). The activity of making tables and organizing data were good (30%), moderate (31%), and bad (39%). The worst was the ability to use simple statistics to analyze data (88% bad, 7% moderate, and 5% good). In science, the ability to use simple statistic is very important because it enables students to think critically (Han & Ryan, 2017) and to augment abstract meaning from reality (Mevarech & Kramarski, 2003).

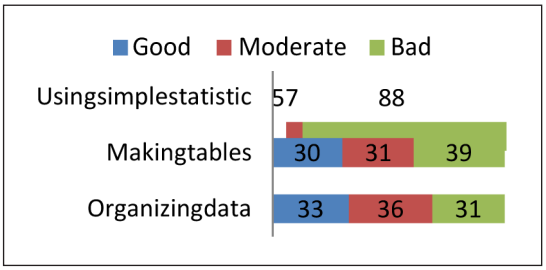

Figure 5. The percentage of teachers that promote students in doing M4

The M4 was also activities to analyze data. This activity included three activities: read data (28% good, relate variables, and construct conclusions. Most teachers do not able to promote students in reading data (43% moderate, 29% bad), do not relate variables (43% moderate, 47% bad), but they ask students to draw conclusions (36% good, 43% moderate, and 21 bad). It means that students draw conclusion mostly from inferring what they observed not from analyzing data (Figure 5).

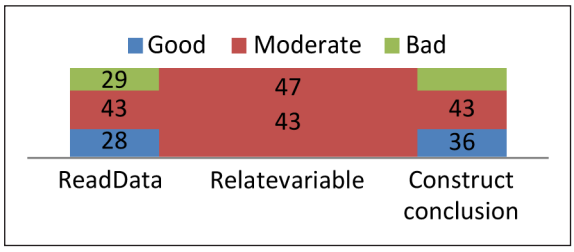

Figure 5. Percentage of teachers that promotes students in analyzing data

The M5 was communicating the results of learning. This activity includes presenting orally, writing a report, and making a product. The research showed that the ability of teachers in promoting students to present the result orally was good, but very low in promoting writing a report and in creating a product (51.5% and 76.5%) (Figure 6). (Watagodakumbura, 2013; Coskun, Dogan, & Uluay, 2017).

Many teachers presented a picture (s) on a biology phenomenon; however, the phenomenon mostly did not problematic. As the topic of addictive and additive substances, but the teachers do not pose a problem to study. In this case the teacher should say "Let focus on the characteristics of the people that abuse drugs", "Can you notice, the effects of drug abused?" etc. In addition, some teachers were confused between observing in the M1 and in the M3. The observing in the M1 is to bring students to the context to identify the problem that stimulates students to ask questions (Chiappeta & Koballa, 2010). It is different from observing in the M3 which is acquiring data from an experiment or an exploration.

The implementation of M2 (Asking questions) was still dominated by the teacher. When in the opening phase the failed to present objects and asked students to observe and to find the problem, they failed to promote students in asking question. When the students did not ask any question, then, the teacher asked questions. In average, the number of students who ask questions was less than 10%. Data also Figure 6. The percentage of teachers to promote students ability in communicating

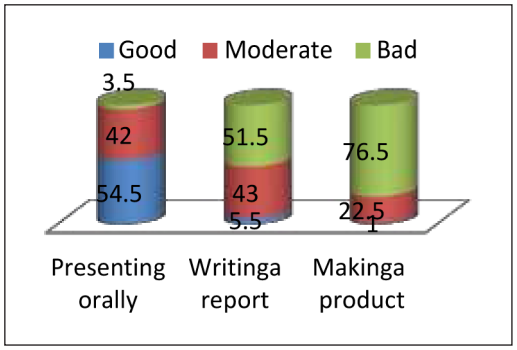

Figure 6. The percentage of teachers to promote students abilityin communicating

Discussion

The implementation of the C13 using the scientific method with 5 Ms still faced many problems. In implementing M1, the teacher mostly asked students to see a picture on screen or to in the students book. Learning biology in authentic way requires teacher to bring objects of biology and ask students to observe the objects showed that the students mostly

ask "W" questions, such as what, where, and when; but less question on why and how. It means that the students still have difficulties in performing higher order thinking skills (HOTS). The "Why" and "How" questions were parts of higher order thinking and also critical thinking skills (Ammundsen, 2001) (Hung & David H. Jonassen; Rude Liu, 2007).

The implementation of M3 (Collecting data) was moderate. The teachers mostly used a table or a form of data that already available in the students' book. However, only a few teachers organize data using a simple statistic model such as total, mean, minimum, maximum, and mode in order to ease students in analyzing the data. The students also try to get information from internet by using computers. However, the number of students who access internet was still low because the limitation of the bandwidth for internet access in schools and the limitation in the number of students who have laptop computers.

CONCLUSION

From the results and discussion, the implementation of the scientific approach with 5Ms on the new curriculum in Indonesia was in moderate category. In doing M1, the teacher mostly did not bring real objects to be observed by the students. In doing M2, the teacher less promoted students to ask "WH" and hypothetic questions. In doing M3, the teacher did not optimally increase students' ability in organizing and analyzing data, specifically in using simple descriptive statistics. In doing M4, the teacher less stimulated students in reasoning, relating variables and theories to draw conclusions. In doing M5, the teacher less encouraged students to communicate their learning results by using written scientific reports and making products.

Implication

The implementation of the C13 with 5Ms will be more succeed if the following aspects are respectively taken into account.

1. Teachers should use more real objects or bring students to real world to learn biology.
2. Teachers have to promote students higher order thinking by asking "WH" and hypothetic questions.
3. Teacher must involve students more in using the scientific approach by designing and doing experiments/explorations.
4. Teacher should be able to encourage students in analyzing data by organizing data, making tables, and using simple statistics.
5. Teacher must support students in communicating their learning outcomes by using written scientific reports and creating products.

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REFERENCES

Alessi, S. M., & Trollip, S. R. 2001. Multimedia for learning: Methods and development (3rd ed.). Boston: Allyn & Bacon. American Association for the Advancement of Science (1993). Benchmarks for scientific literacy. New York: Oxford University Press.

Alshammari, A. 2013. Curriculum Implementation and Reform: Teachers' Views About Kuwait's New Science Curriculum, *3*(3), 181–186.

Alsubaie, M. A. 2016. Curriculum Development: Teacher Involvement in Curriculum Development, *7*(9), 106–107.

Ammundsen, P. 2001. Problem-based Learning in Biology with 20 Case Examples.

Aytan, T. 2016. Evaluation of the 2006 and 2015 Turkish Education Program in Secondary School Curriculum in Turkey in Terms of Critical Thinking, *5*(2), 38–46. https://doi.org/10.5539/jel.v5n2p38

Castaneda, S.F., Holscher, J., Mumman, M.K., Salgado, H., Keir, K.B., Foster-Fishman, P.G., & Talavera, G.A. 2011. Dimensions of Community and Organizational Readiness for Change. *Progress in Community Health Partnerships: Research, Education, and Action.* Vol. 6 (2), pp: 219-226

Cavdar, G., & Doe, S. 2012. Learning through Writing: Teaching Critical Thinking Skills

in Writing Assignments. *The Teacher*. Pp: 298-306

Chandler, L.J. 2001. Implementing Readiness Control Measurements: Defining the Change Challenge Within a MEF. *Marine Corps Gazett.* Vol. 85, No. 9, pp: 65-66

Chan, Jacqueline Kin-Sang 2010. Teachers' responses to curriculum policy implementation: colonial constraints for curriculum reform. *Educ Research Policy Practice (2010) 9:93–106*

Cheung, A.C.K., & Wong P.M. 2011. Factors Affecting the Implementation of Curriculum Reform in Hong Kong. *International Journal of Educational Management.* Vol. 26, No. 1, pp: 39-54. February.

Chiappeta, E. L., & Koballa, T. R. 2010. *Science Instruction in The Middle & Secondary Schools.* New York: Pearson Education, Inc.

Craft, Heddi & Bland, Paul D. 2004. Ensuring Lessons Teach the Curriculum with a Lesson Plan Resource. *The Clearing House*; Nov/Dec 2004; 78, 2; ProQuest. p. 88

Coskun, H., Dogan, A., & Uluay, G. 2017. The Effect of Technology on Students Opinions about Authentic Learning Activities in Science Courses, *5*(1), 72–83. https://doi.org/10.13189/ujer.2017.050109

Ediger, Marlow. 2004. Psychology Of Lesson Plans And Unit Development. *ProQuest Education JournalsofReading Improvement*; Winter 2004; 41, 4;. pg. 197

Goldston, M. Jenice; Dantzler, John; Day, Jeanelle. 2013. A Psychometric Approach to the Development of a 5E Lesson Plan Scoring Instrument for Inquiry-Based Teaching. *Jurnal of Scince Teacher Education,* (2013)24:527–551.

Han, Y., & Ryan, M. 2017. Teaching Strategic Thinking on Oligopoly: Classroom Activity and Theoretic Analysis, *11*(1), 127–139.

Hung, W., & David H. Jonassen; Rude Liu. 2007. *Problem-Based Learning*. DOI 10.1007/978-1-4419-1428-6_210

Jacobs, Christina L., Martin, Sonya N., & Otieno, Tracey C. 2007. "A Science Lesson Plan Analysis Instrument for Formative and Summative Program Evaluation of a Teacher Education Program. *Science Education*, v92 n6 p1096-1126 Nov 2008

Li, Z., Yan, Z. H. U., & Yu, Z. 2014. A Study on Problems and Strategies of Curriculum Resources Development and Utilization by Teachers in Rural Junior Middle School: A Case Study of a County of Sichuan Province in China, *10*(5), 154–158. https://doi.org/10.3968/4809

Mevarech, Z. R., & Kramarski, B. 2003. The effects of metacognitive training versus worked-out examples on students' mathematical reasoning, 449–471.

MoE-aa. 2013. Peraturan MenteriPendidikan nomor 81 A Tahun 2013 tentang Implementasi Kurikulum.

MoE-c. 2013. Peraturan Menteri Pendidikan Dan Kebudayaan Republik Indonesia Nomor 81a Tahun 2013 Tentang Implementasi Kurikulum. Retrieved from https://luk.staff.ugm.ac.id/atur/bsnp/Permendikbud81A-2013ImplementasiK13Lengkap.pdf

MoE-k. 2013. Lampiran Peraturan Menteri Pendidikan Dan Kebudayaan Nomor 69 Tahun 2013 Tentang Kerangka Dasar Dan Struktur Kurikulum Sekolah Menengah Atas/Madrasah Aliyah.

Riley, P. E. 2013. Curriculum Reform in Rural China: An Exploratory Case Study. *Research and Issues in Music Education*, *11*(1).

Aktan, Sümer. 2015. A Review of Curriculum History and the Conceptual Framework of Curriculum History in Turkey. *Educational Policy Analysis and Strategic Research*, *10*(1), 59–70.

Watagodakumbura, C. 2013. Authentic Learning Experience: Subtle But Useful Ways To Provide It In Practice, *Contemporary Issues In Education Research* – Third Quarter 2013 *6*(3), 299–304

Watlington, T. B. 2008. The Impact of a Multicultural Curriculum upon Student Achievement: Perceptions of Potential Dropouts who Graduated from North Carolina's First Early/Middle College High School. *UMI Number 3310954*.