Grounding physics and its learning for building global wisdom in the 21st century

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Abstract. Global wisdom is the values of the prevailing and internationally respected policies. One sector that plays a role in instilling global wisdom values is education and one of them is physics education. Learning physics means learning about content and positive values in it. The article was written by using qualitative research review methods in internalizing positive values and lead to the development of global wisdom in 21st century learning. This research aims to describe components related to the innovative learning and values of global wisdom. The data were the results of our qualitative researches and were supported by the results of researches conducted by educational experts. Grounding physics through innovative physics learning and trusted values of education can build global wisdom. Innovative learning is characterized by new models and provides alternative solutions to problems. Innovative learning oriented to the competences of students in the 21st century which determined by 4C: creativity and innovation, critical thinking and problem solving, communication and collaboration skills. The skills will equip students as problem solvers so they can survive in facing the future. Physics education in a broad sense aims to provide multiskills and contain the value of "scientific wisdom" to face the global era. Physics learning that builds global wisdom potentially solve the challenges of internationalization, universalization, and supraterritoriality. The form of global policy providing students with values of respecting human rights, integrity, justice, humility, upholding order and peace, developing scientific and technological progress, and respecting beliefs or religions for the nations of the world. These values must also be internalized in the teachers's personality as row models for students and must be a belief and reinforcement for their profession.

1. Introduction
Science and technology have developed rapidly in the 21st century that has been experienced by nations in the world. In the present decade, changes in all fields are taking place rapidly or disruption era has been experienced. There are three literatures that determine changes in the disruption era, namely database, human resources, and technology. The development of science and technology has had an impact on the demands that must be made by the community to quickly follow the changing times. Similarly, Physics changes very quickly both in scientific substance and learning methods.

Physics is the oldest science according to its development compared to other sciences. In the field of education, physics education is needed to teach physics to students. The impact of using physics is to make it easier for people to meet and overcome the problems of everyday life. Therefore, physics
has entered various fields of life including, with scientific branches namely star physics, earth physics, environmental physics, medical physics, and biophysics. Considering the importance of Physics and its learning to the public, grounding physics through various fields of life is a very important and urgent demand of the times. Physics and learning are two fields that are difficult to separate from reality. The role of physics and learning, encouraging education actors to direct the qibla to ground physics in all life, both at national and international.

The term grounding appears in the field of education is expected to provide a solution to the problem of education, which still has the view that physics is less desirable and lacks the attention of the world community. Grounding can be interpreted to bury or implant something in the earth. The meaning of the context is to instill physics and its learning to the community to always be in them. Physics is a science that is loved, Physics is knowledge that is possessed, Physics is an easy science, Physics is knowledge around us and Physics is a science that is used as a solution in life. Basically grounding physics and learning is intended to make students literate physics [1].

Grounding physics through learning is the responsibility of teachers, lecturers, and institutions involved in education. Teacher positions as a profession are often questioned by the community, because in the community there are irregularities that the work of teachers is carried out by other professions. Teacher professional development is recognized as fundamental to improving the quality of education [2]. Professionalism of educators grows dynamically and productively if effective and sustainable coaching is carried out. The professionalism of teachers is very strong, determined by skills and motivation. Skills can be realized in mastering subject contents or professional and pedagogical competences by teachers. Skills are obtained by increasing knowledge and skills on an ongoing basis, while motivation must be built on self-awareness to perform best in every performance.

Globalization is proven to create a climate of openness in various fields, now space and time are no longer an obstacle to accelerating the spread of information in the digital era. The development of science and technology has a positive and negative impact on everyday life. The shift of national cultural values is the impact of the climate of globalization and technological progress both directly and indirectly. Efforts to fortify themselves and fill positive activities are explicit targets of education [3]. Students are still encouraged to be able to think globally without forgetting national cultural values (think globally but act locally), but the authors chose to work globally but heart locally.

In the 21st century, professional teacher educators have been faced with a challenge related to national and international competencies and wisdom. Based on the description in the introduction, two main problems were raised in writing the article, namely how to ground physics learning and build global wisdom in the 21st century education.

2. Methods
The article was written by using qualitative research review methods in internalizing positive values and lead to the development of global wisdom in 21st century learning. This research aims to describe components related to the innovative learning and values of global wisdom. The data were the results of our qualitative researches and were supported by the results of researches conducted by educational experts. This article is intended for prospective teachers, teachers, and lecturers as actors and developers in education.

3. Result and Discussion
3.1 Learning Innovative Physics oriented to 21st Century Skills
Grounding physics can be done in various ways, namely innovative education of physics, research, and the application of physics in everyday life. Innovative learning with a scientific approach is characterized by the knowledge constructed by the students themselves through the activities of studying, observing, asking questions, processing, reporting, and communicating their learning outcomes. The essence of innovative learning is learning that is produced from models that are all new or modified by existing models by the teacher [4]. Innovative learning that is intended in the 2013 curriculum is explicitly characterized by students actively involved in learning and sourced from the real world of students. Innovative nature is shown by students capable of solving problems that arise and are faced during learning.
Research on physics learning has been carried out continuously covering the concepts of physics [5, 6, 7] and methods of learning physics [8, 9] for education Senior High School. Physical concepts at the high school level, namely the equilibrium of rigid body, waves, and static fluids have been discussed in the research above. The results of the study stated that critical thinking skills and problem solving were still low. In general, students are interested in the type of physics problem in mathematical and graphical forms. On the other hand, learning methods have been obtained from research results that innovative learning in inquiry and project learning show excellence in uncovering mastery of concepts, skills development, and student learning products [10].

Value education is the process of understanding and internalizing various values held and believed by humans, which are useful in life. Values are normative standards that affect humans and make choices according to what they perceive. Attitudes, thoughts, and beliefs that determine human behaviour must be understood and analysed so that they are appropriate for life. Learning productivity is determined by the meaning of one's self-esteem. Human quality is determined by self-concept, self-image and self-esteem. The impression displayed by someone over themselves is a self concept. Self-image is an assessment of himself, how he judges himself before others. Self-esteem is a thorough assessment of him, how someone knows the real person. In learning, self-culture values are needed, namely the culture of self-value which plays a role in the best learning achievement. Cultural functions are more encouraging for positive and productive thinking [11].

Physics learning in the 21st century requires teachers to follow and to master a number of competencies so that learning is not outdated. Educators in the 21st century should have specific characteristics compared to teachers in previous centuries. Teacher characteristics in the 21st century [12] include competencies:
a) having a high work ethic based on strong religious values,
b) able to utilize science and technology,
c) have communication and social skills,
d) become members of professional organizations and scientific publications,
e) develop the working principle of competing and collaborating.

Modern state, for example the United States has launched in the field of education: Partnership for 21st Century Learning (P21). The learning guide contains competencies needed in the 21st century, one of which is learning and innovation skills (The 4Cs). The 4Cs in question are creativity and innovation, critical thinking and problem solving, communication, and collaboration. Critical thinking skills and problem solving are one important aspect of 21st century skills in the world of education. At present, the priority target of educational institutions is to educate students to be productive, creative, and have the ability to think critically [13]. This shows the importance of critical thinking in education. Education that focuses on critical thinking skills, will produce graduates who are ready to work together successfully, think critically and analytically, communicate effectively, and solve problems efficiently at their workplace [14].

Three strategic mechanisms are needed for success in understanding 21st century skills. First, the wider community must realize the importance of 21st century skills as current education. Second, schools should have a new design for learning that refers to the results of recent research on how people learn information processing, the use of effective technology and 21st century skills in the context of academic content. Third, policy makers should contribute in formulating assessment rules that can measure 21st century academic achievement and skills [15]. Assessment is an important component in the field of education. Improving the quality of education can be done by improving the quality of the learning system and the quality of its assessment.

Teachers, lecturers, and important educational institutions implement learning achievement competencies needed in the 21st century for the advancement of education. Learning achievement competencies that are expected to be mastered by students in the 21st century [16] are: (1) digital era literacy (basic, scientific, economic and technological literacy; visual and information literacy; global awareness and multicultural literacy); (2) inventive or creative thinking (ability to adapt, manage complexity, self-regulation; curiosity, creativity, courage to take risks; Higher order thinking skill (HoTS) skills, convey arguments, (3) effective communication (working in groups, collaboration, interpersonal skills, personal, social and community responsibility, interactive communication, and (4)
high productivity (thinking priorities, developing plans, managing to get results; effective utilization of real equipment, relevant and high-quality products).

The 21st century skills from different aspects can be classified into several fields [17, 18] namely: 1) cognitive abilities include critical thinking, problem solving, and creativity; 2) interpersonal skills include communication skills, social skills, teamwork, cultural sensitivity, and managing difficulties; and 3) intrapersonal skills including self-management, self-regulation, time management, self-development, lifelong learning, adaptability, and executive functions.

The challenges of education in the 21st century are mainly on internationalization, universalization, and regional supra-territoriality. Internationalization is more focused on growth in the exchange and interdependence of education and economics internationally. Universalization is more emphasized in the process of disseminating technology methods and products throughout the world. Supra-territoriality is a geographical reconfiguration, so that social spaces are no longer mapped with territorial areas, territorial distances, and territorial boundaries. The meaning of supra-territoriality is the dissemination and intensification of economic, social, educational, and cultural interactions that penetrate the geographical boundaries of space and time, which must be overcome in order to move more quickly to achieve goals.

3.2 Establishment of Global Wisdom in Physics Learning in the 21st Century

Global wisdom consists of two words, wisdom and global. Global means cross country or reach international regions. Global wisdom is ideas that are wise, full of wisdom, noble values, which are embedded and followed by the international community. Global wisdom can be understood through international policy values. The value of these policies is growing continuously in the international community, binding them to respect and obey these values. The Global Wisdom International School provides an environment that is suitable for the development of children's potential in a way that makes them morally strong, intellectually get caring social information, emotionally balanced and physically developed. Holistic education is education that all activities are oriented towards improving skills and values. International schools provide educational services that focus on the complete personality of students so that they become assets for the international community [19].

Innovative physics learning in the 21st century is characterized by the creation of an active and happy atmosphere in students during physics learning. In such an atmosphere, teachers easily internalize knowledge and values including scientific wisdom in students' lives. The value of global wisdom in its existence is in line with national character values. Thus the results of the analysis of global wisdom can integrate with national character values. The results of the analysis of a number of journal articles provide information that global wisdom can be extracted [20, 21, 22] as presented in Table 1.

| Global Wisdom          | Description                                                                 | Activity Indicators                                                                                                                                 |
|-----------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Respecting human rights | The general rights of human life include freedom, protection and safety        | Giving the right to life and independence of the nation, not involved in colonization and persecution                                                    |
| Integrity             | Having a personality that upholds the interests of the nation and the state more than personal and group interests | Defending national interests from foreign rioters and maintaining national unity, prioritizing national interests                                |
| Fairness              | Not taking sides with certain groups, deciding cases according to regulations, dividing according to the needs of life | Participating in law, enforcing international law, dividing things based on rights and obligations                                                   |
| Humility              | Does not display pride, loves                                                | Be polite, cultivate helpful                                                                                                                         |
Building the progress of science and technology | solutions to problems, and prioritizes benefits | behaviour, act for public benefit or be the best human being  
Upholding order and peace | Improve the quality of life with science and technology, make progress, and create community welfare | Developing science, acting and utilizing technology, does not support negative technological impacts  
Respecting beliefs or religions for the nations of the world | Respect applicable regulations, maintain environmental health, prohibit crime and damage | Spreading love, loving health and beauty, not doing damage (mercy of all nature)  
| Creating a harmonious and loving life, self-control, giving freedom and tolerance in religion and belief | Worship based on adopted religion (prayer), associating with noble behaviour, likes to help others (helping), living in harmony with other religions (tolerant)

A number of factors that cause delays in internalizing the value of global wisdom into the personality of students, namely 1) the focus of learning is divided, 2) low learning work ethic, 3) low emotional smart, and 4) low intrapersonal smart skills, and 5) generation and potential appearance of students are constrained.

4. Conclusion

Global wisdom is the values of policies that are applicable and respected internationally. Grounding physics through innovative learning and "value education" can be used to build global wisdom in education. Innovative learning is characterized by the novelty of the model and provides alternative solutions to problems. Innovative learning is oriented to the competence of students in the 21st century characterized by 4Cs: creativity and innovation, critical thinking and problem solving, communication skills, and collaboration. Physical education in a broad sense provides multi skills and contains the value of "scientific wisdom" to face the global era. Learning physics that builds global wisdom is able to solve the challenges of internationalization, universalization, and supra-territoriality. Grounding physics has a target is to make physics always in one's heart and is believed to be a solution in life.

Global wisdom includes: respecting human rights, integrity, justice, humility, maintaining order and peace, building advances in science and technology, and respecting the beliefs or religions of the nations of the world. Wisdom values should internalize in the teacher's personality a belief and strengthening of their profession. The benefit of internalizing global wisdom is to form the whole personality of students. The internalization of global wisdom in students, who are formed from intellectual, skill, emotional, and "spiritual" aspects, produces a great and commendable generation in the 21st century.

References

[1] Abidin Y, Mulyati T and Yunansah H 2017 Pembelajaran Literasi, Strategi meningkatkan Kemampuan Literasi Matematika, Sains, Membaca, dan Menulis (Jakarta: Bumi Aksara)
[2] Mulyasa HE 2017 Uji Kompetensi dan Penilaian Kinerja Guru (Bandung: Remaja Rodakarya)
[3] Lapsley D and Woodbury R 2016 Act.Teach. Educ. 38 194.
[4] Yulianti D and Wiyanto 2009 Perancangan Pembelajaran Inovatif (Semarang: UNNES Press)
[5] Fitrianingrum A M, Sarwi S and Astuti B 2016 Proc. 3rd Int. Conf. Math., Sci., and Educ. Semarang, Indonesia 3-4 September 2016.
[6] Asmi S, Sarwi S and Masturi 2016 Unnes Phys. Edu. J. 3 1.
[7] Sarwi S 2012 Proc. Int. Sem. Postgraduate Program Universitas Negeri Semarang, Indonesia 16 June 2012.
[8] Sarwi S, Sutardi, and Prayitno W W 2016 J. Pendidik. Fis. Indones. 12 1.
[9] Agtasiaputri C, Sarwi S and Sugiyanto 2015 Pros. Sem. Nas. FMIPA Universitas Negeri Semarang November 28th 2015.
[10] Sarwi S 2016 Pemelajaran Inovatif Fisika, Aktif dan Menyenangkan (Semarang: UNNES Press)
[11] Komariah A and Triatna C 2006 Visionary Leadership Menuju Sekolah Efektif (Jakarta: Bumi Aksara)
[12] Sarwi S 2017 Pros. Sem. Nas. Postgraduate Universitas Negeri Malang, 6 Mei 2017.
[13] İşlek D and Hürsen C 2014 Procedia - Social Behav. Sci. 131 290.
[14] Živkovic S 2016 Procedia - Social Behav. Sci. 232 102.
[15] Osman K, Soh T M M and Arsad N M 2010 Procedia - Social Behav. Sci 9 599.
[16] Kyllonen P C 2012 Measurement 21st Century Skills within The Common Core State Standards (New York: Educational Testing Service)
[17] Soland J, Hamilton L S and Stecher B M 2013 Measuring 21st Competences Guidance for Educators (Rand Corporation ASIA Society)
[18] The Ontario Public Service 2016 21st Century Competencies for Ontario (Canada: Ontario Government Service)
[19] Dilip V, Jeste M D, Ipsit V and Vahia M D 2008 Psychiatry 71 197.
[20] Salloum S 2016 Cul. Stu. Sci. Educ. 12 355.
[21] Stevenson H 2016 Int. Stu. Quartely 60 400.
[22] Akbar S, Samawi A, Arafik M and Hidayah L 2015 Pendidikan Karakter Best Practices (Malang: Universitas Negeri Malang Press)