HIGH SCHOOL STUDENTS PROFILE OF MISCONCEPTION IN KINETIC THEORY OF GASES

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Abstract

Misconception is student conceptions that oppose the scientist`s. The purpose of this research was to describe students` profile of misconception on kinetic theory of gases before and after remedial instructions using discussion learning model. This research used pre-experimental design with one-group pre-test post-test design. Subject of this research is 36 science class student in Lamongan, Indonesia. Before the instructions conduct, three-tier diagnostic test formatted pre-test is given to reveal student misconceptions profile. Physic instructions using discussion learning model then conducted. After the instructions, the same diagnostic test formatted was given as post-test. Collected data then analyzed to describe student misconceptions profile before and after the instructions. The result show that before the instructional there are misconception students got as average in every sub-concept, after the instructions, misconceptions was reduced.

Keywords: Misconception, Remedial, Kinetic theory of gases.

Abstrak

Miskonsepsi merupakan pemahaman konsep siswa yang tidak sesuai bahkan berseberangan dengan konsepsi ahli. Penelitian ini bertujuan untuk mendeskripsikan profil miskonsepsi siswa pada materi teori kinetik gas sebelum dan sesudah pengajaran remedial dengan model diskusi. Jenis penelitian yang digunakan adalah *pre-experimental design* dengan rancangan *one-group pre-test post-test design*. Subjek penelitian adalah 36 siswa kelas XI MIA di Lamongan, Indonesia. Sebelum dilakukan pengajaran, siswa diberikan tes diagnosis miskonsepsi berformat *three-tier*, untuk mengetahui profil konsepsi awal siswa. Pengajaran fisika remidial dengan model diskusi kemudian diterapkan pada materi teori kinetik gas. Setelah pengajaran, siswa kembali diberikan tes diagnosis yang sama. Data yang terkumpul dianalisis untuk dapat mendeskripsikan profil konsepsi siswa sebelum dan sesudah pengajaran. Hasil penelitian menunjukkan bahwa sebelum pengajaran secara rata-rata siswa mengalami miskonsepsi pada setiap sub-konsep, dan setelah pengajaran jumlah miskonsepsi yang dialami siswa menurun.

Kata kunci: Miskonsepsi, Remidial, Teori kinetik gas

BACKGROUND

One of the most problematic issues in education that the solutions had been seeking until now was student misconceptions. Misconceptions appear as the result of the conducted instructions at a cross purposes with student initial knowledge. Misconception can be occur in every field of knowledge, and every topic in that field. In physics, misconception can be occur in every concept (Wandersee, Mintzes & Novak, 1994).

Research on student misconception was based on ideas that student cognitive structure influenced by learning process, and how student construct their cognitive knowledge (Azizoðlu, 2004). Suparno (2013) stated that some of source of misconception was came from individual itself; (1) pre-conception, (2) associative thinking, (3) humanistic thinking, (4) incomplete reasoning, (5) wrong intuitions, (6) stage of cognitive

development of students, (7) student aptitude, and (8) student interest in learning.

Barra (2016) based on his research about identification of physics misconception on state equations and kinetic theory of gases topic, stated that student misconception in the related school up to 64,19%. Most of them was in sub-concept that require operational formal level of thinking (according to Piaget suggestion). Misconception that occurred suspected because of student have not been able to activate their knowledge to kinetic theory of gases scientifically and comprehensively.

In addition, the research of Hufaini (2018) stated that the misconceptions students on the material kinetic theory of gases reached 77.96%. Jauhariyah (2018) based on the results of his research stated that students misconceptions on the material kinetic theory of gases reached 59.38%. Misconceptions occur in sub-sub material properties of an ideal gas, state equation of gas, ideal gas laws, kinetic energy of the gas, and equipartition of energy.

Based on data from a variety of literacy can be concluded that the misconception has been happening and research have done on it since long time ago, the causes of misconceptions, and efforts to reduce it, as is done by She (2002) Situated Learning through teaching Dual Model, and Azizoðlu (2004) through the teaching of conceptual change oriented instruction. Knowing these data, researcher conducted a preliminary study at a high school in Lamongan. Preliminary studies carried out by conducting interviews with some of the students and provide a questionnaire in the form of questions related to the misconception in kinetic theory of gases in grade XI MIA, as well as interviews with physics teachers of grade XI to determine obstacles in the process of teaching physics, student response of teaching, and pre-conception of the average student got before the instructions. Based on the results of initial studies note that there are misconception that experienced by students, difficulties in teaching because of each student's level of intelligence are not the same, a variety of learning styles, and almost every student had to have prior knowledge that the majority was wrong.

RESEARCH METHODS

This study is a qualitative research with pre-experimental design. The design of the study is one-group pre-test and post-test design: O_1 X O_2; O_1 is initial test score before instructions (pre-test), X is a instructions applied, and O_2 is the final test score after instructions (post-test). The experiment was conducted on a sample of 36 high school students grade XI MIA of state high school in Lamongan, Indonesia which has gained material kinetic theories gases in the second semester of the academic year 2018/2019.

The research begins by giving a pre-test in the form of diagnostic tests to determine students' initial conceptions. After pre-test students were given teaching in materials kinetic theory of gases with brainstorming discussion model, then students given the same test (post-test) to determine the students' conceptions after instructions.

Students' conceptions were analyzed based on a combination of the answers to the three-tier test in accordance with Table 1.

Table 1 Conception level based on combinations of answer of three-tier diagnostic test

Possible Options of Student Answers			**Decision**
Level 1	**Level 2**	**Level 3**	
Right	Right	Sure	Scientific conception
Right	False	Sure	Misconceptions
False	Right	Sure	Misconceptions
False	False	Sure	Misconceptions
Right	False	Not sure	Guessing
False	Right	Not sure	Guessing
Right	Right	Not sure	*Lucky Guess*
False	False	Not sure	*Lack of Knowledge*

Source : Maulini, et al (2016)

Collected data in the form of answers to the pre-test, and post-test were analyzed descriptively and qualitatively for student misconceptions profile before and after instructions.

RESULTS AND DISCUSSION

Based on data from the pre-test and post-test, misconceptions percentage of students before and after instructions obtained shown in Table 2.

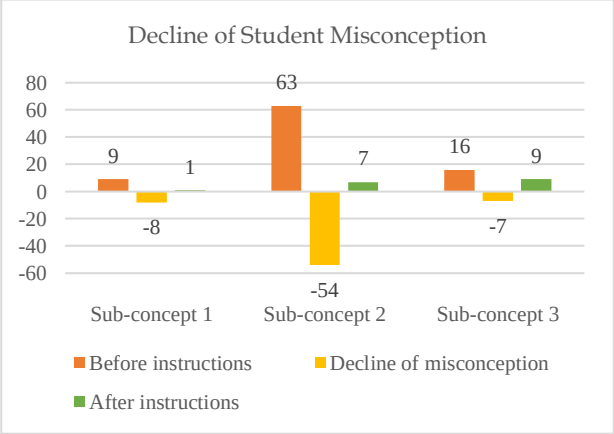
Table 2 Misconceptions before and after instructions

Sub-concept	Before instructions (%)	After instructions (%)	Decrease in misconceptions (%)
Characteristics of ideal gas	64,29	7,14	88,89
The laws and the general equation of ideal gas	64,29	7,14	85,71
Energy and the effective velocity of gas	38,10	21,43	43,75

Based on Table 2, before the instructions there are sizeable misconception held by student, reached 64.29% in the sub-concept characteristics of ideal gas and laws and the general equation of ideal gas, and 38.10% in the sub-concepts energy and effective velocity of gas.

After the instructions, students misconceptions decreased; the sub-concepts characteristics of ideal gas and the laws and general equation of ideal gas became 7.14%, as well as in the sub-concept energy and effective velocity

of gas became 21,43%. Graph of misconceptions decline held by students is shown in Figure 1.



CONCLUSION

Based on data from the above discussion, can be concluded that: there are misconceptions experienced by students in the material kinetic theory of gases in each sub-concept; after instructions, misconceptions held by students was reduced in each sub-concept of kinetic theory of gases.

SUGGESTIONS

Based on the research that has been done, the researcher encountered some difficulties in implementation, for it the researcher put forward some suggestions as follows:

1. Serve phenomena that rarely encountered in daily life and engaging for students.
2. Serve phenomena that will be discussed with appropriate media, so that students are able to know the phenomenon for sure, not only through imagination.
3. Convey teaching with media that supports audio-visual.

BIBLIOGRAPHY

Abraham, M. R., Grzybowski, E.B., Renner, J. W., & Marek, E. A. (1992). Understandings and Misunderstandings of Eighth Graders of Five Chemistry Concepts Found in Tet Book. Journal of Research in Science Teaching. 29 (2), 105-120.

Ahmad, A. (2014). Penerapan Model Pembelajaran Generatif Berbantuan Simulasi Komputer Untuk Mereduksi Kuantitas Siswa Yang Miskonsepsi Dan Meningkatkan Keterampilan Berpikir Kritis Siswa SMA Pada Materi Teori Kinetik Gas.

Alfiani. (2015). Analisis Profil Miskonsepsi dan Konsistensi Konsepsi Siswa SMA pada Topik Suhu dan Kalor. Seminar Nasional Fisika 2015 Jurusan Fisika, Fakultas MIPA, Universitas Negeri Jakarta. SNF2015-IV-29.

Ardiansah, Maykuri, M., & Rahardjo, S. B. (2018). Student certainty answering misconception question: study of Three-Tier Multiple-Choice Diagnostic Test in Acid-Base and Solubility Equilibrium. International Conference on Science Education.

Azizoðlu, N. (2004). Conceptual Change Oriented Instruction And Students' Misconceptions In Gases. Thesis. Natural And Applied Sciences. Middle East Technical University.

Barra, W. N. (2016). Identifikasi Miskonsepsi Peserta Didik Pada Materi Persamaan Kadaan Gas dan Teori Kinetik Gas di MAN Laboratorium UIN dan MA Nurul Ummah Yogyakarta dengan Menggunakan Instrumen Berbentuk Soal Pilihan Ganda Beralasan Terbuka. Skripsi. Pendidikan Fisika. UIN Sunan Kalijaga Yogyakarta.

Dahar, R. W. (2006). Teori-Teori Belajar & Pembelajaran. Jakarta: Erlangga.

Erceg, N. et al. (2016). Development of the kinetic molecular theory of gases concept inventory: Preliminary results on university students' misconceptions. Physical Review Physics Education Research, 12.

Fakharuddin, Azizahwati, & Rahmi Y. (2012). Analisis Penyebab Miskonsepsi Siswa pada Pelajaran Fisika di Kelas XII SMA/MA Kota Duri. Jurnal Pendidikan Matematika, 3 (1), hal. 87-98.

Fungkar, V. (2016). Remediasi Miskonsepsi Siswa Menggunakan Phet Simulation Tentang Materi Rangkaian Listrik Arus Searah SMA. Jurnal Penelitian. Pendidikan Fisika. Universitas Tanjungpura. Pontianak.

Hafizah, Deni, Haris, Venny, Eliwatis. (2014). Analisis Miskonsepsi Siswa Melalui Tes Multiple Choice Menggunakan Certainty of Response Index Pada Mata Pelajaran Fisika Man 1 Bukittinggi. Jurnal Pendidikan MIPA. Vol 1 (1): hal. 100-103.

Handayani, A. D., Sahala, S. S., & Arsyid, S. B. (2013). Remediasi Miskonsepsi Siswa Menggunakan Metode Eksperimen Berbantuan Tutor Sebaya Pada Materi Cermin SMP.

Harizah, Z., Setyarsih, W., & Jauhariyah, M. N. R. (2016). Penggunaan Three-Tier Diagnostic Test untuk Identifikasi Mikonsepsi Siswa pada Materi Teori Kinetik Gas. Jurnal Inovasi Pendidikan Fisika, 05 (03), 174-177.

Hasibuan, J. J. & Moedjiono. (2006). Proses Belajar Mengajar. Bandung: Remaja Rosakarya. (http://library.uns.ac.id/dglib/pengguna.php?mn=sh

owview&id=32436), diakses pada 2 Nopember 2018.

Hufaini, A. M. F. (2018). Identifikasi Kemampuan Pemahaman Konsep Siswa Pada Materi Kinetik Gas Dengan Menggunakan Certainty Of Reponse Index (Cri) Pada Siswa Kelas Xi SMAN 12 Makassar. Skripsi. Pendidikan Fisika. UIN Alauddin Makassar.

Jauhariyah, M. N. R. et al. (2017). The Students' misconceptions profile on chapter gas kinetic theory. International Conference on Science Education, 997.

Jauhariyah, M. N. R. et al. (2018). Validity of student's misconceptions diagnosis on chapter Kinetic Theory of Gases using three-tier diagnostic test. International Conference on Science Education, 1006.

Lestari, P. P. dan Linuwih, Suharto. (2014). Analisis Konsepsi dan Perubahan Konseptual Suhu dan Kalor pada Siswa SMA Kelas Unggulan. Unnes Physics Education Journal. (Online), 3(2), (http://journal.unnes.ac.id/sju/index.php/upej), diakses pada 2 Nopember 2018

Mahmudah, I. R. (2013). Analisis Kesalahan dalam Menyelesaikan Soal Materi Pokok Teori Kinetik Gas Pada siswa Kelas XI SMA Negeri 7 Surakarta Tahun ajaran 2012/2013.

Maulida, F. O., Mardiyana dan Pramudya, I. (2017). Analisis Pemahaman Konsep Siswa Pada Materi Persamaan Lingkaran Ditinjau dari Motivasi Belajar Siswa Kelas XII IPS 4 SMA Negeri 6 Surakarta Tahun Pelajaran 2016/2017. Jurnal Pendidikan Matematika dan Matematika (JPMM). 1(4).

Maulini, S., Kurniawan, Y., & Muliyani, R. (2016). The Three Tier-Test untuk Mengungkap Kuantitas Siswa Yang Miskonsepsi Pada Konsep Gaya Pegas. Jurnal Ilmu Pendidikan Fisika, 1 (2), 42-44.

Maunah, Nailul & Wasis. (2014). Pengembangan Two-Tier Multiple Choice Diagnostic test Untuk Menganalisis Kesulitan Belajar Siswa Kelas X pada Materi Suhu dan Kalor. Jurnal Inovasi Pendidikan Fisika (JIPF), (Online), 3(2): 195- 200, (https://www.scribd.com/doc/225982116/), diakses pada 2 Nopember 2018.

Mustajab, A., Sahala, S. S., & Hamdani. (2013). Remediasi Kesalahan Siswa Menyelesaikan Soal Gas Ideal Melalui Metode Learning Together di SMA.

Nurhuda, T., Rusdiana, D., & Setiawan, W. (2017). Analyzing Students' Level of Understanding on Kinetic Theory of Gases. International Conference on Science Education, 812.

Peşman, H. (2005). Development Of A Three-Tier Test To Assess Ninth Grade Students' Misconceptions About Simple Electric Circuits. Thesis. Science And Mathematics Education. Middle East Technical University.

Peşman, H., & Eryilmaz, A. (2010). Development of a Three-Tier Test to Assess Misconceptions About Simple Electric Circuits. The Journal of Educational Research, 103, p. 208-222.

Rahmi, Y. F. (2016). Identifikasi Miskonsepsi Siswa Pada Konsep Termodinamika Menggunakan Tes Diagnostik Two Tier Multiple Choice (TTMC). Skripsi. Pendidikan Fisika. UIN Syarif Hidayatullah Jakarta.

Ratnasari, W. D. dan Prasetyo, W. K. (2014). Pengembangan Reasoning Based Diagnostic Test Untuk Mengidentifikasi Kesulitan Belajar dan Miskonsepsi Pokok Bahasan Usaha dan Energi. Jurnal Pendidikan Matemarika dan Sains, (online), (https://www.e-jurnal.com2015/04/pngembangan-resoning-based- diagnostic_68.html?m=1) ,diakses pada 2 Nopember 2018.

Séré, M.-G. (1986). Children's conceptions of the gaseous state prior to teaching. European Journal of Science Education, 8(4), 413-425.

Serway & Jawet. (2014). Physics for Scientists and Engineers with Modern Physics. 9th Edition. Boston : Books/Cole.

Shuell, T. (1987). Cognitive psychology and conceptual change: implications for teaching science. Science Education, 71, 239-250.

Silung, S.N.W. (2015). Identifikasi Miskonsepsi Siswa SMA pada Materi Suhu dan Kalor serta Kemungkinan Penyebabnya. Prosiding Seminar Nasional Jurusan Fisika FMIPA UNESA 2015: 180-185.

Silviani, R., Muliyani, R., & Kurniawan, Y. (2017). Penerapan Three Tier-Test Untuk Identifikasi Kuantitas Siswa Yang Miskonsepsi Pada Materi Magnet. Jurnal Ilmu Pendidikan Fisika, 2 (1), hal. 10-11.

Suratno, T. (2008). Konstruktivisme, Konep Alternatif dan Perubahan Konseptual dalam Pendidikan IPA. Jurnal Pendidikan Dasar. Vol (10)

Susanti, Dwi et al. (2014). Penyusunan Instrumen Tes Diagnostik Miskonsepsi Fisika SMA Kelas XI Pada Materi Usaha dan Energi. Jurnal Pendidikan Indonesia. vol 2(2): hal 16-19.

Suwarto. (2013). Pengembangan Test Diagnostik dalam Pembelajaran. Yogyakarta: Pustaka Belajar.

Trianto. (2009). Mendesain Model Pembelajaran Inovatif-Progresif. Edisi ke-1. Jakarta: Kencana.

Uyun, S. Q. (2017). Identifikasi Miskonsepsi Siswa SMA Kelas X Pada Konsep Alat-Alat Optik Melalui ertainty of Response Index (CRI). Skripsi. Pendidikan Fisika. UIN Syarif Hidayatullah Jakarta.

Van Zee, E. H, Iwasyk, M., Kurose, A., Simpson, D., &Wild, J. (2001). Student and teacher questioning during conversations about science. Journal of Research in Science Teaching, 38(2), 159-190.

Wahyuningsih, Y., Raharjo, T., & Masithoh, D. F. (2013). Pembuatan Instrumen Tes Diagnostik Fisika Sma Kelas XI. Jurnal Pendidikan Fisika, 1 (1), hal. 111-117.

Walker, J. S. (2010). Physics. 4th Edition. U.S.: Addison-Wesley.

Wilantara, I Putu Eka. (2005). implementasi model belajar konstruktivis dalam pembelajaran fisika untuk mengubah miskonsepsi ditinjau dari penalaran formal siswa. http://www.damandiri.or.id/cetakartikel.php?id=254. Diakses tanggal 27 Oktober 2018.

Yunawati, R., Hindarto, N., & Sulhadi. (2017). Penerapan Pembelajaran Kontekstual Berbantuan Mindscaping Untuk Remediasi Miskonsepsi Siswa SMA Materi Teori Kinetik Gas. Unnes Physics Education Journal, 6 (1).

Zaleha. (2017). Pengembangan Instrumen Tes Diagnostik VCCI Bentuk Four-Tier Test pada Konsep Getaran. Jurnal Pendidikan Fisika dan Keilmuan (JPFK), 3 (1), hal. 36-42. Aailable at: (http://e-journal.unipma.ac.id/index.php/JPFK)

Zitzewitz, P. W. et al. (2005). Physics Principles and Problems. Columbus : McGraw-Hill.