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Misconceptions observed in physics and tools helping in overcoming the misconception

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Abstract
Some misconceptions are always available in each field of knowledge but identifying and removing of these are more important to stop propagation of this in society. Physics is supposed to be very conceptual subject but concepts should be correctly transferred to students or learners of future generation. Misconceptions are developed at very early age of learning and at very basic level of science teaching to higher level physics teaching. Misconception is a conclusion that is wrong because it is based on faulty thinking or understanding or facts that are wrong. Main cause for this is miscommunication of the facts. Considering the seriousness of this, various studies about misconceptions are available in the literature. This paper deals with the review of misconceptions in physics and ways by which misconceptions may be eliminated using various methods.

Keywords: Misconception, physics, corrective measures.

1. Introduction
As misconceptions are found in all fields of science. In the same manner, there are so many misconceptions in physics also. There are several situations through which misconception may originate. Misconception generates from improper understanding of textbooks during reading. Origin of misconceptions may be from personal experience and imprecise language. Sometimes media representation of phenomena may also be responsible for generation of misconceptions. The new twenty first century learners are sitting in the classrooms. They are ready to explore, design and create new concepts and technologies. If resources are provided them which transform their mindsets to create powerful and effective technology then it will be great effort in the direction of development. It is very essential to understand misconceptions and to remove them as early as possible so that misconceptions may not be transferred to another's mind. Propagation of misconception should be identified and stopped as soon as possible.
Understanding of misconceptions depends on experience and on active learning. The identification of various misconceptions have led to new ideas for teaching physics both at secondary and undergraduate levels[1]. We are living in the era of fast-growing science and technology. To go ahead with the whole world, we need tools and devices which are least time consuming as well as high result oriented. Therefore, to achieve the aim one must consider the best tool that influences human to human interaction. All means of mobile and computer-supported communication are fastest and cheapest in the present scenario of the world. These provide a huge amount of information to the entire group of persons on a single click. That is why this paper reviews misconceptions in the physics and available technical tools which can be used to reduce misconceptions among the students and teachers.

2. Methodology and discussion
Present study is based on review of the literature for which literature has been surveyed and tried to give idea about misconceptions using examples and methods which can help in removing the misconceptions.

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3. Common Misconceptions in physics

There are large number of examples of misconceptions in the physics. In which few examples are as force and motion[2], laws of motion, hot and cold[3], floating and sinking, sizes of the body parts, shape of earth, density, particulate nature of matter, properties of matter etc. Energy and momentum conservation is also one of the topic which shows misconception. Analysis of result show that various misconceptions arises in students at basic level[4].

Here one example of misconception related to physics shows that on the basis of small number of observations, how one can generate misconception. In solid state theory, the theory of the nature of the glass and the glass transition was a kind of short puzzle. Older concept was "It is well known that pans of stained glass in old European churches are thicker at bottom because glass is a slow moving liquid that flows downwards over centuries"[5-6]. After that it was observed that the thicker end has been installed to the sides or the top. Therefore, it suggested that medieval stained-glass makers were simply unable to make perfectly flat panels and the windows were just as unevenly thick when new. In this, computer simulation has become sophisticated and large enough to provide additional insight, and yet more theories have been profound to explain glass.

In another case, diverse instructional strategies on students understanding of the shape of the earth has been studied by Hayes, B.K. et al[7]. Newton's canon ball was a thought experiment that Issac Newton used to hypothesize that the force of gravity was universal and that it was the key force for planetary motion. Thought experiment are used when particular physical experiments are impossible to conduct[8].

Generally, some students and also many people think that a body needs constant force to keep on moving. If such constant force will not be provided then moving body will come to rest. But we know that according to Newtons first law of motion "Everything at rest will stay at rest, and everything in motion will stay in motion". Although by understanding this law it can be said that constant external force is required to overcome the friction force. If friction force is not present then body will keep moving.

In thermodynamics, it is common notion among the students that heat rises but the fact is different than this. Actually, heat is considered as energy in transit. Other misconception is that heat is the energy that can be stored in a system but truth is that heat energy cannot be stored in a system it is energy in transit.

In thermal equilibrium, when two bodies at different temperatures brought to contact then energy flow takes place from higher temperature to lower temperature and after attaining thermal equilibrium heat flow stops. But truth is that energy flow in a specific direction stops.

From above discussion it is clear that heat is not an entity but it is a process.

Another misconception is that there is no gravity in outer space. Although correct concept is that there is gravity in outer space weaker than on the earth. But astronauts don't experience gravity because of a constant state of free fall of the moon or planets. The weightlessness situation may also be experienced in free fall of the lift.

There is a general misconception among the people. Some people think that theoretical physicists are wasting time in discovering out the fundamental principles of the universe. Although after having proper understanding it is clear that this research work is very useful because this will provide basic knowledge for next generation of experiments.

There are several examples showing misconceptions in physics in which few examples have been discussed above. On the basis of above discussion, it is clear that each learner is required to be careful during learning of concepts.

4. Methods to reduce misconceptions

At present several ways are available using which one can overcome misconceptions in physics. Figure1. Shows few of them which are very effective ways to clear concepts during basic understanding of the physics.

Fig. 1: Showing different ways to overcome misconceptions in physics.

From above figure it is clear that there are three broad categories of eliminating misconceptions in physics: online, face to face and experimental/ practical. Large number of online ways are available, also one can perform experiment/ practical related to particular problem if experimental facility is available.

Internet communication tools are playing great role in reducing the misconceptions in physics.

This section highlights how technology boosts students achievements as well as engagement[9]. Some internet communication tools[10], which may affect conceptual framing are as follows: world wide web, virtual places, whatsapp, power point presentations, online videos, YouTube, portals made available by the government for teaching learning purposes. Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) and Massive Open Online Course (MOOC) are developed with the help of various experts and made available for the learners which can be used to overcome misconceptions.

At present discussion forums like Quora, Reddit, Physics forums, Physics help forum, Physics Stack exchange forums, Sciphysics forums etc are also playing great role in discussing problems and removing misconceptions.

Online and offline mode of Conferences/workshops/ seminar/discussion on specific topic is considered best methods to clear the concepts and to eliminate misconceptions.

Sometimes performing experiment/ practical also help in developing better understanding of the scientific aspects of any phenomena.

5. Conclusions

On the basis of review and discussion, there are following conclusions:

1. Generation of misconception depends on various factors during learning process as discussed above. Therefore, learner is required to use more and more references in the learning of a concept.
2. It is assumed that use of technical tools in classroom teaching and outside the classroom discussion with traditional lecture methods will definitely reduce the development of misconceptions in physics but this assumption is required to be tested experimentally on large scale.
3. Various discussion forums like Quora etc., conference, seminar and technical session should be used to remove misconceptions by discussing the different aspects of scientific methods/ principles with the experts of the specific area of physics.

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