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THE IMPACT OF PRESENTATION GRAPHICS ON PRESERVICE SCIENCE TEACHERS' ATTITUDES TOWARDS PHYSICS

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Abstract. *In this study, the effects of presentation graphics on Preservice Science Teachers' (PST) attitudes towards physics were investigated. The research was performed on two groups. While one group was an experimental group, another was a control group. The research was conducted in the context of an undergraduate-level physics course, and this course was taught to two groups. While the experimental group consisted of forty PST and was taught with presentation graphics as well as traditional lecturing method, the control group consisted of forty PST and was only taught with traditional lecturing method. The data were collected by means of a scale of attitudes towards physics. In light of the findings of the present research, it was concluded that the attitudes of the experimental group towards physics were much more improved positively than the control groups' attitude toward physics after the treatment involving presentation graphics.*

Key words: *attitudes towards physics, presentation graphics, preservice science teachers.*

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Introduction

Physics is perceived as a difficult course for students from secondary school to university levels, and it is well known that both high school and college students find physics a difficult scientific discipline to succeed and avoid from it because of its negative reputation among students (Erdemir, 2009; Teo, 2008). The student success in physics is lower than chemistry and biology, that most of the students do not prefer the physics courses in their education life (Boylan, 1996; Mattern & Schau, 2002; Rivard & Straw, 2000). In science education literature, the most important reasons for the lack of success in physics have been suggested as little usage of Information and Communication Technologies (ICT) such as the presentation graphics in teaching physics and students' low attitudes towards physics (Craker, 2006; Normah and Salleh, 2006; Long, 1981; Newble, 1998).

At this point, it is necessary to explain the meaning of attitude or interest especially in science education research context. Attitude is a mental position relative to a way of thinking or being, and it is an evaluative construct favourable or unfavourable related to a person, object or event (Erdemir & Çepni, 2007). A positive attitude implies a way of thinking that is predominantly positive and optimistic. The opposite inclination, a negative attitude is predominantly pessimistic. Osborne, Simon, and Collins (2003) defined attitudes towards science as "are the feelings, beliefs and values held about an object that may be the enterprise of science, school science, the impact of science on society or scientists themselves" (p. 1053). In terms of conceptualization of the interest in the present study, situational interest was considered. Situational interest is defined as a type of interest that is spontaneous, transitory, and

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environmentally activated (Krapp, Hidi, & Renninger, 1992). It is also "changeable and partially under the control of teachers" (Schraw, Flowerday, & Lehman, 2001, p. 212). According to the text-based learning research, a situational interest or positive attitude is the result of certain text characteristics or context where the text has been presented (Hidi & Baird, 1986; Krapp, 2002). Several factors interrelate with the development of positive attitude considering learning of science, like the perceived relevance of science from the point of view of everyday life, further studies or occupation, interestingness of the content or a context where certain science content or topics are met (Craker, 2006, Erdemir, 2009; Erdemir, 2011). Consequently, the context where the textual or pictorial information is presented or how the relevance of topic is demonstrated could have an influence to the development of an attitude of a student.

Among the studies of presentation graphics so far, the majority highlighted that presentation graphics improve the interest level of students in the classroom (Apperson, Laws, & Scepansky, 2006). Especially, context-based approaches have had an influence students' interest in science positively (Bennett, Hogarth and Lubben, 2003). Because students' attitudes are so important to future involvement in the subject, it is useful to know how presentation graphics are trying to develop attitudes. If the present study report that students find physics course to be more interesting and attention capturing with presentation graphics, it is reasonable that they may show more success and engagement to physics course. We predicted that presentation graphics would make the physics courses more entertaining and interesting, and students would present positive attitudes or interests towards Physics courses. Accordingly, this study focuses on a strategy for increasing attitude in a physics classroom, carefully selecting well-organized texts. The researchers investigated the effects of coherence, relevance, vividness, and prior knowledge in the presentation graphics on PST's situational interest or positive attitudes towards Physics lessons. Since situational interest (or text-based interest) or positive attitudes have a profound facilitative effect on learning (Hidi, 1990) it is worth to study what factors influence situational interest or positive attitudes.

Until now, numerous studies (Amare, 2006; Beets & Lobingier, 2001; Elby, 2001; Szabo & Hastings, 2000) have been conducted to determine the factors that related to the students' attitudes or interest in science. One of the most distinctive factors that relates students' attitudes or interest towards physics has been the use of presentation graphics (Craker, 2006; Mattern and Schau, 2002; Morrell & Lederman, 1998; Normah and Salleh, 2006; Rivard & Straw, 2000). Studies have consistently indicated that use of presentation graphics facilitated students learning and attitudes towards physics in a positive way (Apperson, Laws, & Scepansky, 2006; Atkins-Sayre, Hopkins, Mohundro, & Sayre, 1998; Beets & Lobingier, 2001; Mantei, 2000; Rankin & Hoaas, 2001; Szabo & Hastings, 2000). For example, Apperson et al. (2006) studied undergraduate students to explore the effects of the use of presentation graphics on their experiences in the classroom. According to the results of the study, clarity, entertainment and interestingness of the content or a context in presentation graphics improved their attitudes or interests in the classroom.

Studies involving presentation graphics also suggested that if the course instructors used presentation graphics, students would be more organized, clearer, and more interested to the course. Among the studies involving the presentation graphics conducted so far, the majority emphasize that presentation graphics increased the interest level of the classroom experience in the physics course (Frey & Birnbaum, 2002; Rickman & Grudzinzki, 2000). For example, in a study by Szabo and Hastings (2000), 155 undergraduate students were administered a 10-item questionnaire to measure how they felt about the use of presentation graphics (compared to a traditional lecture format). Ninety percent of the respondents believed that presentation graphics were more attention capturing interesting and enjoyable than traditional lectures and 85% said that it was more interesting. The characteristics of presentation graphics such as color, variation in font, image, dynamic model building, or multimedia capabilities might impact students' interest in a positive way. In addition, the visual clarity and the emphasis on important concepts, and better structured writings in the presentation graphics maintained students' attention to the lesson content (Szabo & Hastings, 2000). Atkins-Sayre et al. (1998) also found that students believed presentation graphics enhanced an instructor's delivery, and more importantly, their credibility.

Research Focus

The current study was conducted to examine the benefits and perceived benefits of use of presentation graphics in a physics course. In other words, students' attitudes towards physics with the help of the presentation graphics were assessed in this research context. Although many researchers argue that using the presentation graphics has great impact on students' interests and attitudes towards different subject areas, the influence of the presentation graphics on students' interests or attitudes towards physics specifically have not been examined yet. Also, in order to facilitate students' success in physics, it is important to examine their attitudes towards physics when the presentation graphics are used for students. Therefore, the main purpose of the research is to investigate the effects of the presentation graphics on preservice science teachers' attitudes towards physics.

1. Is there a statistically significant difference between pre-test and post-test scores of the control group in terms of their attitudes towards physics?
2. Is there a statistically significant difference between pre-test and post-test scores of the experimental group in terms of their attitudes towards physics?
3. Is there a statistically significant difference between pre-test scores of experimental and control groups in terms of their attitudes towards physics?
4. Is there a statistically significant difference between post-test scores of experimental and control groups in terms of their attitudes towards physics?

Methodology of Research

General Background of Research

The pretest-posttest control group research design (Fraenkel & Wallen, 2006) guided the present study. In this design, two groups of subjects are used, with both groups are measured twice. The first measurement is named as pretest and the second is named as posttest, and these measurements are collected at the same time for two groups of subjects (Fraenkel & Wallen, 2006). In this section, participants of the study, the instrument, data collection, and data analysis are presented.

Sample of Research

This study was conducted with 80 PST in the fall semester of 2007- 2008 academic year in the context of an introductory physics course. These science teacher candidates were enrolled in the department of science education in a big Eastern University in Turkey; when they graduate, they would be science teacher in the middle schools (grade 6th through 8th). There were only two groups of PST in the university who enrolled in the introductory physics course at the time of data collection. In their first years, PST must take this course because this course is a must and a prerequisite course for future physics courses during their education. The university where the study was conducted is only university in the city and since there were only two groups of PST whose number was 40 for each, the sample of the present study consisted of these two groups. Data were collected totally from 80 PST, 30 female and 50 male, aged 17–23 years (M = 19.18, SD = 4.13). The PST were volunteer to participate in the study. Both the experimental group and the control group consisted of 40 PST, who anonymously completed the questionnaire. Among the groups, one group was randomly selected as a control group and another was selected as an experimental group.

Research Instrument

An Attitude towards Physics Scale (ATPS) was used in the present study to explore PST's attitudes towards physics (see Appendix 1). The ATPS is a five-point Likert scale (with 1 being Strongly Disagree and 5 being Strongly Agree) and consisted of 25 items. In order to enhance statistical understandability,

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point distances were categorized as "Absolutely agree (4.20-5.00), "Agree (3.40- 4.19), "Undecided (2.60-3.39), "Disagree (1.80-2.59) and "Absolutely disagree (1.0-1.79) (Erdemir, 2009; Erdemir, & Çepni, 2007; Yenilmez, 2008). Based on these criteria, mean scores as 3.39 (threshold value) and above were assessed as positive opinion within the context of our evaluations.

The ATPS was developed and validated by the authors in their previous research (Erdemir, 2009). The total score for each attitude category indicated level of favorable attitude in that category. Eight of the thirty items are related to willingness, eight are related to perseverance and nine are related to self-confidence. However, they were not considered in sub-scale. Score for the negative items was re-coded so that all the items had a positive value of measurement. Experts in Science education helped to examine the 25-item attitude scale. They also helped to identify the positive and negative statements. The reliability determination of the instrument was carried out by using Cronbach's alpha method with the scores acquired from the responses of sixty students. Cronbach's alpha was found to be 0.81. Additionally, the factor analysis of the instrument was done, and expert views about the instrument were taken to construct a valid instrument. Therefore, based on the satisfactory reliability and validity results of this instrument, it was directly used in the current study.

The Content and Structure of Presentation Graphics

While only the traditional teaching method (lecturing) was exposed to the control group, the presentation graphics with the traditional teaching method was exposed to the experimental group. The presentation graphics was a kind of power-point presentation and prepared with the help of Microsoft Office Power Point 2003 program. The presentation graphics mostly consisted of certain components: figures, graphics, and texts. These components for each physics topic (vectors, motion in one dimension, planar motion (two dimensions), particle dynamics I and particle dynamics II) were reflected in the screen from computers. The researchers investigated the effects of coherence, relevance, vividness, and prior knowledge in the presentation graphics on students' interests or attitudes towards physics course. Based on the situational interest (or text-based interest) approach (Hidi & Baird, 1986; Krapp, 2002), while preparing presentation graphics, coherence and relevance of texts, and vividness of figures and graphics in presentation graphics were considered. Presentation graphics included relevant and coherent texts, and vivid figures or graphics explaining physics concepts and process. When it was necessary, prior knowledge about a physics topic was also given in presentation graphics. Texts in the presentation graphics were carefully well-organized. For example, one presentation graphics include no more than five lines, and two figures or graphics. Texts in a presentation graphics and following presentation graphics were also relevant and coherent. Overall, texts, graphics and figures in presentation graphics were prepared as colourful, in a large font size and simple to get students' attention and interest to physics course.

In the first week, presentation graphics including figures (see Appendix 2), texts and graphics regarding the topic of vectors were presented to PST. During the second week, presentation graphics including figures (see Appendix 2), texts and graphics regarding the topic of motion in one dimension were presented to PST. In the following weeks, this method was kept for the all remaining course topics. All presentation graphics implementation lasted in eight weeks. For providing better interestingness and attractiveness about physics topics, the graphics and figures were mostly selected from the daily life. For example, about the topic of "motion in one dimension", the figure explaining balloon movement (see Appendix 2, figure 4) was selected. Generally, the principles related to the physics topics were presented visually. For example, related to the topic of "horizontal shot", this event was presented with the picture in the presentations graphics. Therefore, the PST observed all steps of "horizontal shot" easily (see Appendix 2, figure 5). Moreover, when the PST want to take notes about important parts of contents of presentation graphics, sufficient time was given to them. As a last note, when it was necessary, the course instructor read some presentation graphics, including texts about the topics. At the end of the presentation graphics presentation, the instructor summarized related topic. If the PST asks questions to the instructor about the topic, the instructor went back to the related presentation graphic, and provided the necessary information with the help of related presentation graphics.

Research Procedure

As a first step of the research process of the present study, the ATPS was implemented for both groups. The introductory physics course including basic physics concepts and procedures was taught to both groups in eight weeks (2 days per week, 4 hours total) in the fall semester of 2007-2008 academic year. The same physics topics were taught to both groups by the same course instructor. While the physics course was instructed to the experimental groups with the assistance of the presentation graphics as well as traditional lecturing method, and the same course was instructed to the control group using only lecturing method. The lecturing method included a direct speech to the students by the course instructor and writing related concepts and procedures to the blackboard (Apperson et al., 2006). The course instructor used the same textbook, tests and lecture materials during the instruction; the only difference in the experimental group was the use of the presentation graphics as well as lecturing. The content of the course consisted of a group of mechanics concepts (vectors, motion in one dimension, planar motion (two dimensions), particle dynamics I and particle dynamics II). The procedure followed in the present study is summarized as below:

- The PST was given the ATPS as pre-test, and then the teaching physics was started.
- The experimental group was instructed with the presentations graphics as well as lecturing, and the control group was instructed with only lecturing. The instruction period was completed in 8 weeks (32 hours).
- Students from both groups completed the posttest (the ATPS).

Data Analysis

The pretest and posttest mean and standard deviation scores of each group's attitudes towards physics were calculated and presented using SPSS 13 statistical package program in the result section. Then, different kinds of t-tests were used in the present study. To compare pre- and posttest scores of both experimental and control groups, a paired- samples t-tests were used. In addition, to compare pre- or posttest scores between experimental and control groups, the independent samples t-test was used. All of the statistical comparisons were achieved with the assistance of SPSS 13 statistical package program. Before conducting both types of t-tests, the assumptions of these tests were met by the researchers.

Results of Research

The means and standard deviations of the pre-test and post-test scores were calculated and t-test was applied to check the difference between the mean scores of the groups.

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Table 1. t-test analysis results concerning pre-test and post-test scores of the control group (CG).

Measurement	N	M	SD	df	t	p
Pre-test (CG)	40	3.20	0.638	39	-1.745	0.094
Post-test (CG)	40	3.27	0.682			

*Significant at level $p < 0.05$

As a first attempt, pre-test and post-test mean scores of the control group were compared. As seen in Table 1, the mean scores of the pre-test and post-test of the control group were determined as M = 3.20, M = 3.27, and standard deviations of the pre-test and post-test of the control group were determined as SD = 0.638, SD = 0.682 respectively. The t-test was conducted to test whether or not there was a statistical significant difference between the pre-test and post-test mean scores of the control group,

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and it was determined that there was not a significant difference between the pre-test and post-test scores of the control group ($t_{(39)}$ = -1.745, $p > 0.05$).

Table 2. t-test analysis results concerning pre-test and post-test scores of the experimental group (EG).

Measurement	N	M	SD	df	t	p
Pre-test (EG)	40	3.144	0.709	39	7.658	0.000
Post-test (EG)	40	3.693	0.630			

Significant at level p < 0.05

As a second attempt, pre-test and post-test mean scores of the experimental group were compared. As seen in Table 2, the mean scores of the pre-test and post-test of the experimental group were determined as *M* = 3.14, *M* = 3.69, and standard deviations of the pre-test and post-test of the experimental group were determined as *SD* = 0.709, *SD* = 0.630 respectively. The t-test was conducted to test whether or not there was a statistical significant difference between mean scores of the pre-test and post-test scores of the experimental groups, and it was determined that there was a significant difference between the pre-test and post-test scores of the experimental group ($t_{(39)}$ = 7.658, $p < 0.05$). This significant difference indicated that using presentations graphics created a positive effect on PST's attitudes towards physics course.

Table 3. t-test analysis results concerning pre-test scores of experimental and control groups.

Measurement	N	M	SD	df	t	p
Pre-test (CG)	40	3.20	0.638	78	1.394	0.176
Pre-test (EG)	40	3.14	0.709			

Significant at level p < 0.05

As a third attempt, pre-test scores of the experimental and the control groups were compared. As seen in Table 3, the mean of the pre-test score of the control group was determined as *M* = 3.20, and the mean of the post-test score of the experimental group was determined as *M* = 3.14, and standard deviations of the pre-test of the control group and the experimental group were determined as *SD* = 0.638, *SD* = 0.709 respectively. The t-test was conducted to test whether or not there was a statistical mean difference between the pre-test scores of the control group and the experimental group, and it was determined that there was not a significant difference between the pre-test scores of the control and experimental groups ($t_{(78)}$ = 1.394, $p > 0.05$). According to this finding, it can be claimed that initial attitude score level of the both groups were the same at beginning of the experimental manners.

Table 4. t-test analysis results concerning post-test scores of experimental and control groups.

Measurement	N	M	SD	df	t	p
Post-test (CG)	40	3.279	0.6822	78	-6.538	0.000
Post-test (EG)	40	3.693	0.6302			

Significant at level p < 0.05

As a last attempt, post-test scores of the experimental and the control groups were compared. As seen in Table 4, the means of the post-test scores of the control and experimental groups were determined as *M* = 3.27, *M* = 3.69, and the standard deviations of the post-tests of the control and experimental groups were determined as *SD* = 0.682, *SD* = 0.630 respectively. The t-test was conducted to test whether or not there was a statistical significant difference between the post-test mean scores of the control and experimental groups, and it was determined that there was a significant difference between the post-test mean scores of the control and experimental groups ($t_{(78)}$ = -6.538, p < .005). This significant difference indicated that using presentation graphics in physics course had more positive effect than traditional (lecturing) methods on the PST's attitudes towards physics.

Discussion

Many instructors anticipate students to assay to figure things out using a variety of techniques-working and tools through the examples in the book when physics commences to get difficult for them, talking to friends and colleagues. An important component of the tools that help build understanding is the appreciation that one's current understanding might be wrong, and that the mistakes one makes can give guidance in helping to correct one's errors. Then, if students have not positive attitude toward physics, necessary knowledge and a great perseverance to overcome this difficulty**,** they can give up trying with physics course. These are feature completing one another for achievement. Precondition of the course enjoying is to possess positive attitude toward course.

Some students who come to university with serious negative attitudes and prejudgment about how to do physics make the transition to become excellent students and successful student in the classroom. In addition, their view of the nature of physics topics affects how they interpret what they hear. The students who have negative attitudes towards physics course may be reluctant toward work extremely hard, but they still find themselves unable to succeed. Some courses may actually recompense students with inconsistent attitudes, such as those who choose memorizing to understanding, while driving away students who might surpass in science given a more supportive structure. It is not only physics concepts that a student brings into the physics classroom. Each one student fetches to the physics class a set of attitudes, beliefs depended on their own experiences, and supposition about what sorts of things they will learn what skills will be required, and what they will be expected to do. All these behaviours can affect student's attitudes toward physics course and performance later.

The findings in the present study showed that there was not a statistically significant difference between pre-test and post-test scores of the control group in terms of their attitudes towards physics. These results suggested that traditional teaching methods seem to be not effective on PST's attitudes towards physics. In spite of the fact that the figures and graphics about physics topics were drawn by the instructor during the traditional-based instruction, these figures and graphics were not remarkable and clear as the figures and graphics in the presentation graphics. The figures and graphics on the board were generally not detailed and only symbolize the real picture of concepts and processes in physics. However, figures from the daily life in presentation graphics may provide positive attitudes towards the physics topics for PST. For example, the picture 1 in the Appendix 2, the man in the picture carries box to the truck, can be very remarkable to PST.

Another finding of the present study was that there was a statistically significant difference between pre-test and post-test scores of the experimental group in terms of their attitudes towards physics. PST in experimental groups responded more favourably use of the presentation graphics. It seems that the use of presentation graphics may have created a generally favourable impression of the experimental groups. These results suggested that in order to increase PST's attitudes towards physics, it can be necessary to implement teaching methods embedded with different equipments and technology such as presentation graphics. If teachers enrich their learning environment with presentation graphics including well-organized, coherent, and relevant texts and many vivid pictures and graphics from daily life, this may influence PST's attitudes towards physics in a positive way.

In order to control internal validity threats such as history in the experimental design of the present study, PST's attitudes towards physics for both groups were checked before the treatments. The results showed that there is not a statistically significant difference between pre-test scores of experimental and control groups in terms of their attitudes towards physics. Therefore, it might be claimed that the researchers of the present study were successful to control some kind of internal validity threats such as history.

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The last finding of the present study showed that there was a statistically significant difference between post-test scores of experimental and control groups in terms of their attitudes towards physics. Previous research reported that presentation graphics use in physics course was positively correlated with attitude towards physics (Shashaani, 1997). In part, using presentation graphics more frequently and developing a variety of presentations related skills and techniques increased positive attitudes of the students as a whole. This widened one's learning horizon and potential that in turn promoted a positive feeling towards the physics courses (Houtz & Gupta, 2001). In light of text-based learning approach, the researchers in the present study considered importance of prior knowledge, organization, coherence and relevance of texts, and vividness of figures and graphics in the presentation graphics in order to improve PST's situational interest or positive attitudes towards physics lessons. Accordingly, the figures and graphics in presentation graphics were more remarkable and clearer as opposed to the traditional teaching method in which teachers only drew pictures or graphics on the board. Moreover, with presentation graphics, teachers could show many more pictures in less time. They could make backward and forward on presentation graphics including pictures in order to compare pictures. As a last advantage of presentation graphics, using colorful and remarkable sings on figures and graphics in presentation graphics might get PST's attention to physics topics. Moreover, selections of pictures and graphics from daily life experiences and having sufficient time to discuss and question these figures and graphics in presentation graphics might influence PST' attitudes towards physics in a positive way. Unfortunately, most of these opportunities did not exist in traditional teaching methods.

The PST showed more positive interests and attitudes towards the physics course instructed with the use of presentation graphics. The results supported in studies conducted by Mantei (2000), Rankin & Hoaas (2001) and Szabo & Hastings (2000). Rather, it seems that the use of presentation graphics made for a better experience for teacher candidates from their perspective because they would be teacher after graduated. It can be claimed that this confers an enormous benefit towards science education in that students like physics courses better and therefore have a more favourable attitude toward their science education.

Conclusions

PST would be science teacher in future are change agents in schools. They play important roles in technology integration in the schools and classrooms. It is important for them to possess positive interests or attitudes towards physics course with presentation graphics, since positive attitudes have been found to be linked to use of the presentation graphics in future classrooms. Overall, this study suggested a need for teacher educators to provide a conducive and non-threatening environment for preservice teachers to experience success in using the presentation graphics aided instruction, with a view to allowing preservice teachers to gain competence and confidence in using instructional tools for teaching and learning.

There are also several limitations in the present study. This research was done with a small cohort of candidates from department science education in a faculty of education. Thus, to check whether these results are general, more students from a variety of many faculties are needed. Initially, the data collected was through self responds and this may lead to a common method variance, a situation that may expand the true associations between variables, resulting in artificial significant results. Secondly, the sample size in the present study is relatively small, thus limiting the extent to which the results of the present study may be generalised. Lastly, the variables chosen in this study were determined by the selection of the experimental and control groups for data collection. Eventually, other important variables that can affect candidate's attitudes towards the physics course are kept out, leading to some limited understanding of PST attitudes.

Future research may contain a comparison of the results of this study against a larger sample using a longitudinal design to examine PST attitudes towards physics over time. Different variables could be added to investigate their effect on PST attitudes towards physics. It is expected that that future studies of PST beliefs and factors that influence these beliefs, such as gender or other demographics will shed light on PST's interests and how this is affected by instruction.

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Appendix 1

ATTITUDES TOWARDS PHYSICS SCALE

The following scale was designed to learn your views on the physics course. Please read each statement carefully and tick off your choice.

1. Absolutely disagree
2. Disagree
3. Undecided
4. Agree
5. Absolutely agree

Male ( ) Female ( ) Age: ( )	1	2	3	4	5
1. Physics course does not frighten me					
2. Physics course is among my likes					
3. I like to study physics course in advance					
4. I will use the things learnt during physics course in my life					
5. I feel tense while studying physics course					
6. I feel comfortable when I solve a new problem in physics course					
7. It is worth doing to learn physics course experiments					
8. It is not attractive to solve physics course problems					
9. Facing problems in physics course, I try to solve them until I find the answer					
10. While studying physics course, I do not want to stop studying it					
11. I am not worried about studying physics course					
12. Succeeding in physics course is important for me					
13. I rely on my knowledge about physics course					
14. I enjoy talking about physics course with others					
15. I enjoy physics lesson					
16. I do not want to hear even the name of physics course					
17. I do not want to take physics lesson					

Male ( )	Female ( )	Age: ( )	1	2	3	4	5
18. The lessons other than physics course are more important for me							
19. The topics in the physics course confuse my mind							
20. Physics course is a boring lesson							
21. Physics course is one of the frightening lessons							
22. I feel helpless while studying physics course							
23. Physics course is not an interesting lesson for me							
24. I would take more physics course if I had that opportunity							
25. I hate physics course lesson							

Appendix 2

Figure 1.

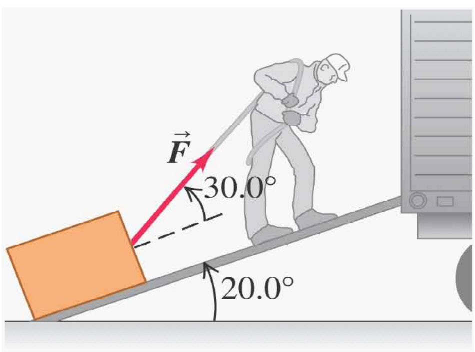

Figure 2.

Figure 3.

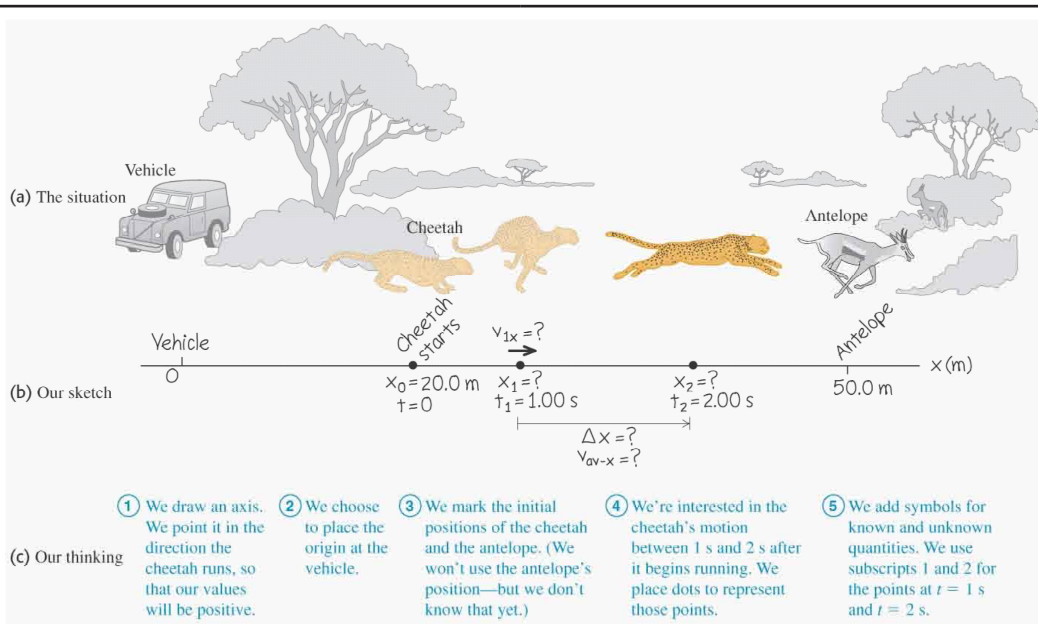

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Figure 4.

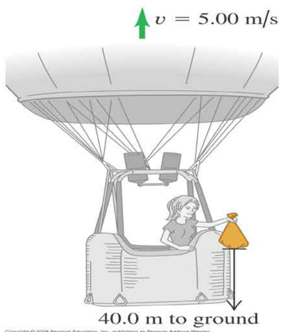


Figure 5.

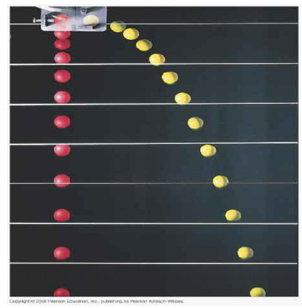


Figure 6.

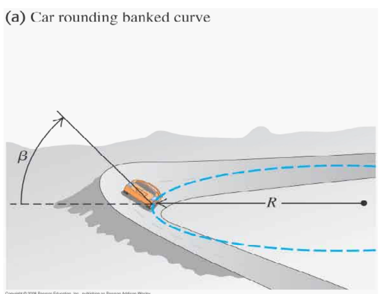
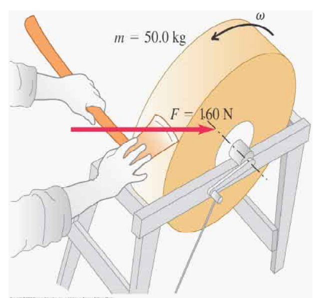


Figure 7.



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