

*Full Length Research Paper*

# Prospective teachers' views about video-enhanced general biology instruction

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The aim of the study is to determine the views of the prospective physics and chemistry teachers about the video-enhanced General Biology instruction. The participants included 19 second-year prospective teachers (10 in Physics and 9 in Chemistry Education) at Necatibey Faculty of Education, Balıkesir University, Turkey in the 2011-2012 academic years. Data were collected using semi-structured interview technique and analyzed by descriptive and content analysis techniques. The results of the study showed that the video-enhanced General Biology instruction increased the participants' interest in biology and made learning more permanent. However, a few participants complained about problems such as language that the videos showed in the courses was mostly in English, Internet connections, opening video links and downloading videos. There is a need for more video clips related to biology concepts on a university level in the Turkish language or it may be useful to translate videos from English to Turkish. Teachers should be more competent in the more effective use of educational tools such as websites and videos in biology courses.

**Key words:** Video, video-enhanced instruction, General Biology, prospective teachers, qualitative research, biology education.

## INTRODUCTION

The purpose of a biology course is not only to prepare students for the university entrance exams but also to provide them with biological literacy. In their work, Kurt et al. report that prospective biology teachers are not as biologically literate as may be desired and that they are unable to make the conceptual association between their knowledge of biology and daily life. They cannot turn their knowledge of biology into practical knowledge (2009). Although biology is interlaced with our daily life, some students still do not like this course, have difficulty and trouble understanding it.

There are many studies in literature that investigate

learning difficulties and misconceptions about biology concepts such as diffusion (Yıldırım et al., 2004), photosynthesis (Ekici et al., 2007), photosynthesis and respiration (Ören et al., 2010; Tekkaya and Balcı, 2003), diversity of organisms and classification (Türkmen et al., 2002), classification of vertebrates (Çinici, 2011). Genetics concepts such as cell division, mitosis and meiosis were hard to learn by students (Bahar et al., 1999; Çimer, 2012; Dikmenli, 2010; Kara and Yeşilyurt, 2008; Murniza et al., 2012; Tekkaya et al., 2001; Topçu and Şahin-Pekmez, 2009; Williams et al., 2011). For instance, Bahar et al. (1999) studied with 207 first-year

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university students studying biology. They found the concepts of diffusion and osmosis, obtaining food and animals in plants, enzymes, active transport and secretion of material, defense mechanisms in plants the least difficult. On the other hand, they perceived the concepts of monohybrid and dihybrid crosses and linkage, genetic engineering, meiosis, gametes, alleles and genes related to genetics the most difficult. Similarly, Topçu and Şahin-Pekmez (2009) asserted that 128 elementary school students in İzmir, Turkey had major difficulties in learning genetics, the function of cell and chromosome concepts and other related concepts.

Akçay (2009) indicated that 407 pre-service science teachers in Turkey showed a success level of 57.9%. The topics they were most successful in were circulation in animals, environmental pollution and control, recycling of waste materials, respiratory system and health. On the other hand, the most unsuccessful topics were variations on Mendel's theory, protists, fungi, plants and animals, human genetics, energy metabolism, oxygen consumption, energy flow in live systems, ecosystems and biosphere, plant reproduction, fertilization and embryology. In other study, while Turkish high school students perceived the concepts of hormones, genes and chromosomes, mitosis and meiosis, nervous system, and Mendelian inheritance difficult to learn, they found the concepts of cells and organelles, and ecology easy to learn (Tekkaya et al., 2001). Çimer (2012) has stated that cycles of matter, endocrine system and hormones, aerobic respiration, cell division, and genes and chromosomes were the most difficult topics in biology for 11<sup>th</sup> grade students in Rize, Turkey.

The actors that can play a role in causing learning difficulties in biology may include the nature of a topic, a teacher's style of teaching, students' learning and studying habits, students' negative feelings and attitudes towards a topic and lack of resources (Bahar et al., 1999; Çimer, 2012, 2007; Topçu and Şahin-Pekmez, 2009). For the subject of biology to be more effective and permanent, it is important to understand first of all how teachers and students perceive the course and what their expectations are. For instance, Prokop et al. (2007) reported that biology was not popular among students and that it was elected by only 145 (15%) out of 941 elementary school students in grades 1-9 in Slovakia. Fifth-grade students had difficulties in botany. Sixth grade students were attracted to zoology. Girls had more of an interest and less difficult in biology than boys as well. In their study, Altunoğlu and Atav (2005) and Yeşilyurt and Gül (2008) showed that teachers believed that students had a negative attitude toward the subject of biology because they came to class with inadequate knowledge from elementary school. They would like to have the textbooks reviewed in terms of content, and learn how subjects can be taken up in class, and about suggestions for other methods that can assist in teaching.

Therefore, teaching biology through several strategies (i.e. using practical work, teaching biology by connecting

topics with daily life, making learning biology interesting, reducing the content of the biology curriculum, using word association tests, grids, concept maps, conceptual change texts, analogies, and concept cartoons) can be useful to overcome learning difficulties and to eliminate misconceptions in biology and make biology learning more effective (Bahar, 2003; Çetin et al., 2004; Çimer, 2012; Ören et al., 2010).

Teachers also need educational videos and games as well other educational materials in Science and Biology classes. Teachers can use Internet to benefit from different technologies that include virtual laboratories, videos, animations and other different technologies in their classrooms (Şorgo et al., 2010). Videos are teaching aid materials and they can be used educational purposes like motivate learning and provide permanent learning since they can be watched anytime. For instance, materials can be provided from websites like YouTube and DailyMotion (Yıldırım and Özmen, 2011). Users can either look for these themselves online or they may be provided with these ready for use (Başaran and Gönen, 2012; Genç, 2013; Kellam, 2010; Pekdağ, 2010; Pekdağ and Maréchal, 2007).

Many studies related to videos are used for educational purposes. For instance, Murniza et al. (2012) developed a learning support tool that made use of a scenario-based learning approach to a virtual biology laboratory and was integrated into a system that enhanced teaching and learning. Croker et al. (2010) developed videos using domestic-quality equipment as self-directed guides for students without the need for any professional audio-visual training, aiming to integrate this approach into laboratory-based learning to support lectures, but these proved to have a low production quality. They presented the following results from the study: More autonomous learners, more time to pool and analyze class data, demonstrators' time being used for higher-level interaction with students, and the production of reusable learning materials for practical implementation in the laboratory. Computer-assisted instructional materials were effective in understanding photosynthesis (Taş et al., 2006) and cell division (Kara and Yeşilyurt, 2008).

Furthermore, making use of an interactive video is significantly effective in terms of learning about outcomes and learner satisfaction in e-learning environments among other lecture settings. Interactive instructional videos may be integrated into e-learning systems (Zhanga et al., 2006). Kellam (2010) incorporated digital video resources into an online educational environment (ePhysicianHealth.com) to increase learning outcomes. Many of the participants thought that the digital videos made positive contributions to making the learning environment more authentic, memorable, varied, realistic, and accommodated different learning styles. As stated by Brecht (2012) many students found online video lectures helpful in understanding topics, that they received better grades, experienced a greater ease of learning, and that course dropout rates were reduced when compared

with the alternative of not conducting video lectures.

On the other hand, Escalada and Zollman (1997) showed although there were no significant differences between the experimental and control groups in an introductory college physics course, students could perceive interactive videos as easy to use and effective. In the study of Karamustafaoğlu et al. (2012), it was observed that the students generally liked Vitamin software program containing activities and tests, used in Science and Technology classes, but were thought to be too scant, and the lack of a question-asking feature as well as the difficulty of the existing questions was sources of discontent. Başaran and Gönen (2012) developed a website including videos, animations and problem-solving aids such as true-false questions, open-ended and multiple-choice questions and other instructional materials for physics units of force and movement. This website was useful for students' success in physics, but there were some technical problems such as the lack of opportunity to access the Internet during out-of-class hours and also problems with the students' computers.

With regard to watching films/video clips in class, Pekdağ and Maréchal (2007) and Berk (2009) recommend that teachers allow the students to watch a film at the start of the class before instruction begins, pointing out that this may provide the foundation for understanding the topic that will then be taught. The teacher may consequently be able to form an association between the film and the topic and help the students in their comprehension. Another alternative would be for the teacher to run the film after instruction is given on the topic. This is useful in terms of helping the students better understand the concepts taught. This method is also effective in allowing the teacher to structure a discussion to help students grasp the relationships between concepts. Similarly, Tan and Pearce (2011) point out videos are just teaching aids and the use of videos was effective for learning. Videos should be also supported with explanations and discussion in classroom. It can be visited the website "Video using in education" for further information about integrating videos to a course.

What is important is that biology videos or animations on the subjects to be taught in class with content that is useful for course goals are found and selected on the Internet. The videos should be chosen according to various criteria. For example, to avoid distraction and disinterest, video playing times should not be too long, sound and image quality should be good, content should be scientific and current and of a quality that will attract the students' attention; the videos should also be explanatory, using animation or real time shots to make the content more comprehensible and visually appealing. "Although many video curations sites have their own standards, calculations, ratings and measures for judging the quality of a given video, it does not mean the video will work for you and your students. It is important to preview the videos and evaluate them with your goals

and objectives in mind." (Tucker, 2013, p.6). Later, careful planning should be carried out as to how these are to be integrated into the lesson. The teaching planning should also determine the teaching methods and techniques that will be used outside of the videos in biology instruction; other classroom materials should also be selected and the potential problems that may arise with showing videos in classroom should be taken into account. Videos can be shown during the courses, even beginning or end of the course. This is also important in terms of providing the students with the opportunity of reviewing and reliving the experience of the course and therefore, videos play lists should be accessible for the students (Croker et al., 2010).

In Turkey, increasing number of schools and classrooms with access to the Internet diversifies teaching methods and techniques recently. Thus, instead of relying solely on lecturing and using slides, teachers will be able to conduct their classroom teaching using various materials from the Internet. On the contrary, Kahyaoğlu (2011) stated that though the elementary school science teachers and classroom teachers thought that using new technologies in class was very effective, the rate of using such technologies in Science and Technology instruction was noticeably low. Taşçı et al. (2010) presented similar results. Although the technological infrastructure of schools had improved, there were still a remarkably high percentage of teachers who were either not using these new techniques or using them very rarely. This finding indicated that teachers need to take pre-service computer and foreign language courses to improve their skills in using the new technologies (Altunoğlu and Atav, 2005; Yeşilyurt and Gül, 2008).

Nonetheless, "The educational use of video on campus is accelerating rapidly in departments across all disciplines-from arts, humanities, and sciences to professional and vocational curricula. Faculty, librarians, and administrators expect their use of video in education to grow significantly over the next five years ... Faculty and administrators expect the sources of their video to shift from offline analog storage to online delivery" (Kaufman and Mohan, 2009, p.2).

A review of the related literature shows that there are some studies on, for example, the expectations of biology teachers in the context of teaching biology more effectively (Altunoğlu and Atav, 2005) or with regard to the views, usage and preferences of students with regard to the video class materials used in distance learning (Esgice et al., 2012) as well as the students' views related to the use of a software program (Karamustafaoğlu et al., 2012).

However, no research has been encountered on the views of the prospective teachers in Turkey on video-enhanced General Biology instruction. We think therefore that the findings of the present study will contribute to the literature.

## Purpose of the study

The purpose of the study was to determine the views of the prospective physics and chemistry teachers about the usage of the video-enhanced General Biology instruction. Four research questions guide the study:

1. What are the expectations of the prospective physics and chemistry teachers with regard to General Biology instruction, and the video-enhanced General Biology instruction?
2. What are the views of the prospective physics and chemistry teachers with regard to General Biology instruction, and the video-enhanced General Biology instruction?
3. What are the views of the prospective physics and chemistry teachers with regard to the contributions of the video-enhanced General Biology instruction?
4. What are the views of the prospective physics and chemistry teachers with regard to the constraints in the video-enhanced General Biology instruction, and what are their suggestions?

## METHOD

The qualitative research method aims to obtain detailed results rather than to generalize the results of the study. As this study is of a descriptive nature, qualitative methodology was used to address the research questions in this study (Yıldırım and Şimşek, 2006).

### Participants

While a total of 34 prospective physics teachers were enrolled in second year undergraduate General Biology courses I and II, 30 prospective chemistry teachers were enrolled in total in the same courses. Convenience sampling method was used in the study (Büyükoztürk et al., 2013). The participants of the study were 19 prospective teachers (10 in physics and 9 in chemistry education) at Necatibey Faculty of Education, Balıkesir University in Turkey during the 2011-2012 academic years. Interviews were conducted with individuals on a volunteer basis.

### Video-enhanced General Biology instruction

Biology is an important course for other disciplines such as physics and chemistry teacher education, since it provides a background for understanding the relationship between the students' knowledge of biology and daily life (Kurt et al., 2009). Biology aims to integrate the students' knowledge of physics and chemistry with biology. Knowledge of biology can be also useful in the event that the prospective physics or chemistry teachers eventually become science teachers.

Prospective physics and chemistry teachers take General Biology I and II courses as required courses in line with the second year program at the Necatibey Faculty of Education, Balıkesir University. While biology courses are 2+0 credits in physics teacher education, they are 3+0 credits in chemistry teacher education (Balıkesir University Information Package/Course Catalogue, 2014). Programs and credits of General Biology I and II Courses at the university are determined by the Council of Higher Education in Turkey.

The aims of the General Biology I and II courses are to use a systematic and logical approach to being able to realize relationships between subjects and between the subjects and other areas. The contents of the General Biology I encompass the basic components of life, cells, cell types, cell events, classification logic, the classification of living things, ecosystems, relationships between living things, tissues, systems and relationships between systems, respiration, photosynthesis, and an overview of biology topics according to systematic logic. The content of the General Biology II includes cell cycles, mitosis division, meiosis, DNA, RNA, protein synthesis, heredity, plant physiology, an introduction to evolution, and ecology (Balıkesir University Information Package/Course Catalogue).

The author of the present study teaches General Biology I and II to both the prospective physics and chemistry teachers. This study is based on video-enhanced General Biology instruction. As Pekdağ and Maréchal say "Making use of films in the classroom is not only convenient for the teacher in teaching the topic at hand, but the method is also helpful to students because it allows them to more easily construct the concept in their minds" (2007, p.78). Moreover, videos clips may develop critical thinking, decision-making and creativity (Logan, 2013).

A computer, a projector and the Internet were employed in each classroom in the study. However, the cable Internet connection in the classrooms was not working well at the Necatibey Faculty of Education, Balıkesir University. Since the author of the present study, who was the instructor of the General Biology I and II courses, was using videos in her classes for the first time, her inexperience led her to encounter some problems with opening up links and downloading videos. At the time of the study, in the 2011-2012 academic years, the video-enhanced instruction was not very widespread in the faculty. Although the use of videos in classes is much more common today, traditional methods are still used to a greater extent. Although the Turkish Ministry of National Education Department of Educational Material Production provides a limited supply of videos and films to be used at different class levels, films are still not commonly used in education. This may be because of the limited funds allocated to education, technical infrastructure deficiencies at the schools, a limited store of film archives, and the limited number of studies on educational practices (Yakar, 2013).

The steps in teaching the General Biology I and II courses in the study were as follows:

At the start of each class, the topic for that session and how it would be treated was explained. In the next classes, students were given homework related to the next topic at the end of the session. In each class, the students were reminded about the topics of the previous week and their preliminary knowledge about their research assignments was assessed. The class proceeded with the reading/explaining of current news on biology. This practice helps the students in the discussion of their assignments, not only in learning the new topic but also in being informed of various issues related to biology. This is beneficial to the students in terms of helping them form an association between biology and their daily life (15-20 min). Later on in the class, Word documents, PowerPoint presentations, videos related to biology concepts were used to review the new topic. The techniques of questions and answers, discussions, providing examples from daily life, and group work were used.

The class watched videos or sometimes animation links brought to class by the teachers and/or students. The students watched the Turkish videos or animations. If the videos or animations were in the English language, the teacher made a summary of the English videos and animations, translating the content into Turkish. Some students were able to comprehend the English videos and animations. When videos or animations were too long (i.e., 10-15 min), the students were presented with only some parts of the videos. The videos or animations were stopped from time to time so that the summary could be given. In short, the explanations of the

topics were reinforced with videos and animations. Sometimes after the watching of the video, the students were asked to give the class their own summaries.

In addition, the classes also included only one session where biological materials such as bacteria and fungi were examined under the microscope in the laboratory or shown by demonstration techniques. Once the varieties of plants in the schoolyard were pointed out, the topic of plant classification was reviewed. During the classes, homework was given to the students to urge them to research news items on biology and also delve into the topics that would be treated in the next week. A summary was made, which ended the session at the end of the classes.

The Turkish or English biology videos used in General Biology I and II classes were selected according to the content and objectives of the General Biology I and II courses mentioned above, although there are a variety of science and biology videos available on the Internet. Care was also taken to show the students real life or short video clips. This was because Biology is a course taken in high school (MoNE Commission, 2013) and on a university level (Campbell and Reece, 2008) that is taught orally and in which many of the concepts are referred to in their Latin forms. Other teaching methods and techniques are needed if students are to internalize these concepts. It is very important that students at the university level are provided with videos suitable for use in their Biology courses and that these are presented to them preferably in the classroom. In this way, students will seize the opportunity of seeing many things in real-life videos about which they have had only abstract notions; the animations they watch will give them the chance to envision the concepts in their minds and bring them to life. It should be ensured that the videos will help to clarify topics in the student's mind and that the videos or animations will not lead to misconceptions about the topics.

First of all, many science and biology videos prepared in Turkish/Turkish translation or in English on the Internet were reviewed for the study. Since not many Turkish/Turkish translation biology videos that suited the content and objectives of the General Biology I and II courses were available on the Internet, the author of the present study decided to use the biology videos and animations in the English language in the General Biology I and II classes. The Turkish biology videos were mainly chosen from several websites such as 'Website of Turkish Science and Technology', 'The Living World' and 'YouTube'. The English language biology videos used in the classes were mainly culled from 'YouTube', 'TeacherTube' and 'Dailymotion'. Some Turkish videos such as 'Oxidized waste of foods SHIT' and 'Diction training-how to breath correctly?' were used in the classrooms, while some English videos such as 'The Six Kingdom Classification: Part 1, Animals, Plants, & Fungi', 'Bacteria Multiplying', 'Bread Molds' were shown (See Appendix A). Most websites and videos are open access resources. However, the required permissions were obtained from some of the persons or companies featured on the websites and in the video clips.

#### Data collection tool

Data were collected at the end of the General Biology II course using semi-structured interview technique (Yıldırım and Şimşek, 2006; Büyüköztürk et al., 2013). This is a preferred technique because of the flexibility it allows to ask different types of questions (Miles and Huberman, 1994). A pilot study was conducted to design the interview questions with 2 teacher trainees before the core study. The scope of the questions in the interview was tested with a pilot study to determine the number of questions to be included in the interview form and their comprehensibility. The final version of the interview form had six open-ended questions after the necessary corrections were made. A mathematics educator in the education faculty validated the interview form. The interviews were conducted on the basis of volunteerism and were held face-to-face.

The interviews with the 19 subjects were completed in approximately 6-10 min and were recorded on a voice recorder.

#### Data analysis

Prior to the analysis of the interviews, the prospective physics teachers were numbered as PS1-PS10 and the prospective chemistry teachers were assigned the codes CS1-CS9. All of the voice recordings of the 19 participants were transferred to the electronic medium and transcribed. These recordings and transcriptions of the audio-tape are on file.

The analysis of the data was performed with the qualitative research analysis method of descriptive and content analysis techniques (Yıldırım and Şimşek, 2006). Themes and sub-themes were not pre-determined for the research questions; these were obtained from the answers the participants gave to the questions in the interview. The statements or concepts described by the participants in their responses to the questions were listed first and then categorized under themes and sub-themes according to each question in the interview. Themes and sub-themes corresponding to each question derived from the participants' responses were checked and re-checked and the needed corrections were made. Care was taken to ensure that each sub-theme featured aspects independent of the others. The coding was repeated many times by the author at intervals. This provided intra-rater reliability. Frequencies of sub-themes for each question were calculated and tables were drawn up. If only one person had expressed a statement or concept with respect to a sub-theme, this was not included in the table but sometimes the view of that person was inserted into the text.

Although there was a total of 19 interviewees, sometimes a participant or participants responded with more than one statement in answer to a question. These were considered as different sub-themes. Although there were 10 prospective physics teachers and 9 prospective chemistry teachers in the study, sometimes the total frequency for physics and the total frequency for chemistry exceeded 10 or 9 respectively. The real names of the participants mentioned in the text were not rendered and instead, the prospective physics and chemistry teachers were assigned codes. For example, PS5 represented a prospective physics teacher and CS5 represented a prospective chemistry teacher. Interesting remarks made by the participants were rendered in quotations accompanied by the participant's code, e.g. "... " (CS5).

Inter-coder reliability was established by a faculty member and the researcher of the study. After data were coded, themes and sub-themes were established and compared. Two researchers had a consistency between themes and sub-themes.

## FINDINGS

### Expectations of the General Biology instruction

When the first question was asked of the prospective physics and chemistry teachers about what their expectations were regarding the General Biology instruction, only PS5 and CS8 expressed an interest in General Biology, but they said they had no expectations. The other participants' expectations about the courses were collected under two themes: Learning and teaching (Table 1).

According to Table 1, the expectations about the participants regarding the General Biology instruction were observed to be more associated with the learning

**Table 1.** Frequencies of themes and sub-themes related to the expectations of the General Biology instruction.

Theme	Sub-theme	Some examples of quotations	P f	C f	T f
Learning	Learning about themselves and environment/nature, examining plants and animals, learning what they contribute to nature and what nature contributes to them	“The biology course is for learning about people and also animals; we examined the plants ... In order to get to know our environment, and in certain situations such as poisoning incidents. We ate some mushrooms, for example, and got poisoned. We need to know that the mushrooms were the reason. Some cycles occurring in nature are again related to biology.” (PS1)	6	1	7
	To remediate deficiencies, reinforcing what has been learned, learning new things	“When I think of biology, I think of living beings, the animal world, plants, etc. A flower blossoms, for example. I would like to learn what the characteristics of a flower are ...” (PS8)	1	2	3
	Learning useful information about daily life	“... I've always been deficient in biology. Learning about my deficiencies, learning about myself and my body ...” (PS6)	1	2	3
Teaching	Memorizing and reviewing the topics in high school	“... To learn things I don't know, to reinforce what I've learned a bit more.” (CS6)	1	2	3
	More applied teaching, an association with chemistry/difficult	“... To learn about general things we don't know about life and biology or about say, a flower, an animal or a plant ...” (PS2)	3	1	4
		“... Instead of learning details about human or animal anatomy, I would like to learn something general about people, plants and animals ...” (CS3)	-	3	3

P: Physics Teaching; C: Chemistry Teaching; T: Total

theme rather than with the teaching theme.

*Theme 1. Learning:* Compared to the prospective chemistry teachers, the expectations about “learning about themselves and environment/nature, examining plants and animals, learning what they contribute to nature and what nature contributes to them” were greater in the prospective physics teachers. On the other hand, the expectation frequencies of both the prospective physics and chemistry teachers in the sub-scale of “to remediate deficiencies, reinforcing what has been learned, learning new things” and “learning useful infor-

mation about daily life” were close to each other.

In short, many participants reported that they wanted to learn more about themselves, the environment, animals and plants in particular, in General Biology classes and to learn how all of these interact with nature. It was observed that the participants expected to see some kind of relationship between the lessons and daily life; they wanted to make up for their deficiencies, reinforce what they had learned, and learn something new.

*Theme 2. Teaching:* Some participants thought that the General Biology classes would be taught by having the lessons memorized. PS7 expected that the classes would

be repeats of the subjects taught in high school, CS5 thought that the classes would concentrate on practical instruction, and CS7 waited for the course to be connected to chemistry. CS4 however expected the classes to be difficult and said:

*I thought that the biology course would be a little harder ... They always taught us by lecturing, they always made us memorize ... I thought the course was not based on memorization because it had been enriched with videos and visuals. (CS4)*

It can be seen that some of the participants expected the class work to be based on memorization and that they had never seen General Biology courses taught in this way. Additionally, although one participant in the physics education thought that the class would be a repetition of high school topics, some prospective chemistry teachers apparently expected the class to concentrate on applications, be associated with chemistry and be challenging to them.

To sum up, while the prospective physics teachers largely expected to get to know themselves and the environment, to examine plants and animals and learn about their interactions with nature, the prospective chemistry teachers mostly expected to eliminate their deficiencies, reinforce what they had learned, learn new things, and find out useful information about life in general and daily life. Some prospective physics teachers were expecting the classes to be spent with memorization and a repetition of high school topics whereas some prospective physics teachers expected the classes to concentrate on applications, waiting for some association of the course with chemistry, and thinking that it would be difficult.

### **Views of the General Biology instruction**

The second question asked of the prospective physics and chemistry teachers was about how the General Biology instruction was taught and what percentage of class time the videos took up. The explanations of the participants about how the General Biology courses taught were reviewed under theme of methods and techniques (Table 2).

As can be seen in Table 2, the participants said that the General Biology courses were taught using video, discussion, research homework, trips/observations and laboratory techniques. Only one prospective physics teacher (PS1) out of the participants thought that the General Biology classes were generally entertaining but sometimes boring; this participant did not provide any information about the percentage of class time the video used up. Most of the participants (physics 4; chemistry 6) were of the opinion that videos were used in 60-75% of class time. This was followed by 80-90% (physics 3;

chemistry 2), 50/50% (physics 2; chemistry 2), and 30-40% (physics 1). These results suggest that most of the participants believed that videos were used in class too much.

*Theme of teaching methods and techniques:* The thoughts of some of the participants related to the sub-theme of “videos, discussion, research homework, trip observations, laboratory” are presented below:

*... videos [were used] in the first semester. We went out into the yard this semester ... It was very exciting ... looked at female and male organs [of plants] ... We carried out lab work as well. The laboratory class was actually even more exciting ... More stayed in our mind, actually. We examined them, looked at them through the microscope. We watched the videos. (PS1)*

PS1 said that the classes were actually enjoyable and entertaining with the videos and that what was learned in class made a more permanent impression in the mind. On the other hand, PS1 said that when the videos were too long and in English, they were hard to understand and the participants got bored from time to time.

Moreover, some of the participants said that the techniques of the questions and answers and providing examples from everyday life were used in General Biology classes in addition to lectures and videos about the topic; the participants were found to have been satisfied by having the classes taught in this way. PS5's thoughts on the subject are striking:

*A topic was explained and then, examples from everyday life were given in general. Later, the previous subjects were reviewed. 80% of the classes were spent with the video ... The videos attracted my attention. (PS5)*

In conclusion, the participants stated that concentrating on videos in their General Biology classes as a technique and method of teaching took up an average of 60%-75% of class time. The participants also said that the techniques of discussion, research assignments, trip-observations, laboratory work and providing examples from daily life were also employed in addition to the videos.

### **Expectations of the video-enhanced General Biology instruction**

When the participants were asked in the interviews what their expectations were about having the video-enhanced classes, the answers they gave to this question could be collected under two themes: Learning and boring course (Table 3).

As can be seen in Table 3, most of the expectations of the prospective physics and chemistry teachers about

**Table 2.** Frequencies of themes and sub-themes related to the views of the General Biology instruction.

Theme	Sub-theme	Some Examples of Quotations	P f	C f	T f
Teaching methods and techniques	Videos, discussion, research homework, trip observations, laboratory	"... They were more visual classes. They stayed in the mind more, though. The Latin words were provided but we understood more by logic ... The videos were about 6-7 minutes long and we watched 4-5 videos over the course of the class. This took up 30%-40% of class time." (PS4)			
		"The classes were spent in a warm atmosphere with the videos. They generally addressed us and were related to the research we had carried out. They came after we did the homework ... We used videos from the Internet, animations and slides ... The [the videos] took up about 60%-70% of class time ... I first thought that I couldn't learn anything this way. But it was just the opposite; visuals are always important in terms of learning and much more effective ... For instance, when we were studying the ferns, it helped us to learn about how they grow, their forms and structure, and seeing the spores helped us to learn it better." (PS6)	7	8	15
		"The classes were mostly carried out with video shows. There were discussions of about 10-15 minutes after the videos. ... The biology classes made an impact. The videos contributed a lot ... The videos took up about 70% [of General Biology class]." (CS3)			
		"We watched videos in class. Covering the topic not with a lecture but visually was more effective. It was easier for us to understand. The videos were in front of us and they helped us to keep more things in our mind ... Because there wasn't a lecture, we were also given research to do ... They [the videos] took up about 80% [of class time] ..." (CS6)			
	Explanations of the topic, video, question and answer, research homework, laboratory, examples from daily life, reinforcing the topics	"Because the teacher placed more importance on the visual, she used the narrative of the videos to explain the topics. We went to the laboratory. We used the microscope and projections. We examined the plants in the yard ..." (CP9)	3	-	3

P: Physics Teaching; C: Chemistry Teaching; T: Total

taking the video-enhanced General Biology courses could be collected under learning theme.

*Theme 1. Learning:* Most of the participants expected that the videos would help them to more easily understand the topic and keep it in their minds.

*Theme 2. Boring course:* One participant each from the participants had negative expectations about General Biology class being taught with the enhancement of a video but that later on, as the classes progressed, their thoughts had turned positive. In addition, one of the prospective chemistry teachers (CS8) said that the expectation was that it would be a more visual course instead of the usual type of class.

Because four participants (PS1, CS2, CS4 and PS5) gave us nonsensical answers when we asked them about their expectations about the video-enhanced class

approach, the responses of these participants were encoded as "uncategorized."

Briefly, most of the participants said that they expected the videos to help them to better understand the material and that this knowledge would stay with them.

### Views of the video-enhanced General Biology instruction

When the prospective physics and chemistry teachers were asked what their expectations were about having the video-enhanced General Biology instruction, the answers they gave to this question could be collected under three themes: Teaching methods and techniques, microscope and daily life (Table 4).

According to Table 4, many participants had different

**Table 3.** Frequencies of themes and sub-themes related to the expectations of the video-enhanced General Biology instruction.

Theme	Sub-theme	Some Examples of Quotations	P f	C f	T f
Learning	Facilitating understanding and keeping in mind	“... I thought that the video would make me remember it more than the lecture. I can’t always keep what the teacher says in my mind. But when I see something in the video, it’s more important to me, it sticks in my mind.” (PS3)			
		“I thought that teaching with the video would make the lesson more comprehensible. I thought they would be videos that narrated the subject. But they were more interesting than that and it was more entertaining for us.” (CS9)	3	3	6
		“I was waiting for some concrete information. And I was able to get this. Not by memorizing what’s in the book but seeing and feeling with my senses was more effective ...” (CS7)			
Boring course	Boring course	“For example, when I first heard that we would be watching videos in class, I thought I would be very bored. But then I saw that it was good, I was learning good things, without getting bored. The videos were simple to understand and it was good because the topics were connected to each other. For example, we saw plants catching bugs. We had learned about this earlier but we could see from the video exactly what the plant was doing, step by step. I found something way beyond my expectations.” (PS10)	1	2	3
		“We thought that it wouldn’t be any good at first. We were thinking, how effective could it be with a video? But later our expectations were surpassed when we saw that the visuals had a good effect on us ...” (CS6)			

P: Physics Teaching; C: Chemistry Teaching; T: Total.

thoughts about learning General Biology lessons using videos.

*Theme 1. Teaching methods and techniques:* Some examples following the participants’ thoughts: “Explaining subject, watching videos, giving information about the subject or stopping the video and making an explanation/discussion/question and answer” are given in Table 4.

In short, many participants’ descriptions of the video-enhanced General Biology instruction that after an initial explanation was given about the topic, the lesson would continue with the video, and then there would be discussions, and the question and answer technique would be used in class.

*Theme 2. Microscope:* Some examples about the participants’ thoughts on “reviewing cells and cell organelles, bacteria, mitosis and meiosis under the microscope” are given in Table 4. The participants said that they were allowed to see the videos of cells and cell organelles, bacteria, mitosis, meiosis and other organisms under the microscope in the General Biology classes.

*Theme 3. Daily life:* Some examples of the participants’ thoughts on “giving information about developments in biology, topics pertaining to daily life” can be seen in Table 4. In short, the participants emphasized that they

had seen many things in the video from daily life such as plants, deterioration and photosynthesis.

Many of the participants’ descriptions about the video-enhanced General Biology classes were that the lesson would continue with the video after an initial explanation about the topic, and the techniques of discussion or questions and answers would then be used in class. In addition, while the prospective physics teachers emphasized the videos on daily life, which demonstrated plants, animals, photosynthesis and deterioration to the class, the prospective chemistry teachers spoke highly of the videos about looking through a microscope at cells and cell organelles, bacteria, mitosis and meiosis.

### Views of contributions of the video-enhanced General Biology instruction

When the prospective physics and chemistry teachers were asked what the video-enhanced General Biology instruction contributed to the course, the answers they gave to this question could be collected under two themes: Helping to learn and raising interest (Table 5).

According to Table 5, many of the participants had similar thoughts about learning about the contribution of

**Table 4.** Frequencies of themes and sub-themes related to the views of the video-enhanced General Biology instruction

Theme	Sub-theme	Some Examples of Quotations	P f	C f	T f
Teaching methods and techniques	Explaining subject, watching videos, giving information about the subject or stopping the video and making an explanation/discussion/question and answer	"[The teacher] spoke about the topic first and then let us watches the videos. Then she stopped the videos and gave us an explanation about the topic. After the video was over, the students discussed the topic and what they understood about it." (PS9)			
		"... When our teacher was explaining the lesson, we were watching the video very carefully in the beginning. Then she would stop the video, ask about our thoughts about the topic, and then there would be discussions and comments. Then we would continue with the videos." (CS5)	5	3	8
Microscope	Reviewing cells and cell organelles, bacteria, mitosis and meiosis under the microscope	"... We saw the shape of the bacteria ..." (PS8)			
		"... We saw the cell organelles, the mitosis ... " (CS4)	3	6	9
		"... I remember the meiotic division, subjects like cells ..." (CS9)			
Daily life	Giving information about developments in biology, topics pertaining to daily life	"... We saw the fast-forward version of a plant growing ..." (PS7)			
		"... We saw the shapes of the plants ... " (PS8)	6	2	8
		"... Deterioration ....photosynthesis ..." (CS4)			

P: Physics Teaching; C: Chemistry Teaching; T: Total.

videos to General Biology lessons.

*Theme 1. Helping to learn:* The comment made by most participants on the contribution of the videos to the course was "the lessons stayed in our mind and contributed to our learning."

Briefly, the participants seemed to be pleased with having the videos shown in class and emphasized that the videos made learning easier and increased retention.

*Theme 2. Raising interest:* Some examples of the participant's comments in the context of the sub-theme, "raising interest and curiosity through effective and entertaining teaching" can be seen in Table 5. While CS3 said that when they had an exam or when there was a discussion outside of class, the videos came to mind and an association with daily life could be made, CS2 said that the assignment to search for the videos developed their visual and intellectual abilities.

Briefly, the participants said that when they watched the videos in class, they found the lesson much more entertaining and interesting.

To conclude, most of the participants pointed out that the videos made learning the lessons easier, increased their retention, and made the classes much more

entertaining.

### Views of constraints in the video-enhanced General Biology instruction and suggestions

When the prospective physics and chemistry teachers were asked about constraints in the video-enhanced General Biology instruction and for their suggestions, 4 participants in physics education and 3 participants in chemistry education said they were happy with the way the lessons were supported with videos, that this was a very good practice and there was no need for anything extra. For instance,

*I think that everyone should teach using this method because when the class is taught by lecturing, we always have to memorize. But in the video we can see what we're learning and we get a more permanent result. (PS8)*

*... The classes were taught with both videos and also examples from our own lives ... You taught us by having*

**Table 5.** Frequencies of themes and sub-themes related to the views of the contributions of the video-enhanced General Biology instruction.

Theme	Sub-theme	Some examples of quotations	P f	C f	T f
Helping to learn	Helping to learn	"... The videos made the lessons more comprehensible; we learned more theoretical and more practical knowledge. I learned the concepts more easily ... When I looked at a word in a definition, its shape came to mind ..." (PS4)	7	9	16
		"... I had never liked biology until now. We would always have to memorize in lectured class scheme but now the videos in class make the materials stick in our minds. For example, we saw the shapes of the plants, the shape of the bacteria, etc." (PS8)			
		"[About the contribution of the videos to class] If we speak about percentages, the contribution of the videos is as big as 80% ..." (PS6)			
		"... [About the contribution of the videos to class] it's 80% ... We were expecting some visuals in Biology class ..." (CS3)			
Raising interest	Raising interest and curiosity through effective and entertaining teaching	"... We watched a lot of videos in class. It was useful to us in terms of reinforcing the subject matter. The concepts and the narration were in sync ... For someone who doesn't like lectures in biology class, it was much better to do the lesson visually." (CS1)	4	2	6
		"... In a lecture, the subject matter just dangles in the air. When it's given visually, we can understand better how everything works. For instance, we studied the cell. Seeing the cell through a microscope in the video helped us to understand better." (CS6)			
		"I would use videos too if it were me because they make the class interesting. If it was a lecture, children become bored. But when you have visuals like this, I think it's of the greatest benefit. Interest in the course increases, the students aren't distracted, they are curious about what's happening ..." (PS3)			
		"Doing the lesson in class with the video makes the subject matter more permanent and the class interesting ..." (CS8)			

P: Physics Teaching; C: Chemistry Teaching; T: Total.

*us watch the videos and listen to examples, by role-playing ... (CS4)*

*It would be nice to have it stick in our minds and base the material on visuals ... The videos and the subject matter complemented each other ... There were things we knew already but I still think it added new things to learn. (CS8)*

Other participants however pointed to certain problems that occurred while watching videos in class and made suggestions as to how these could be resolved. These were collected under two themes: Video and internet (Table 6).

According to Table 6, the participants mostly pointed to the fact that the videos were in English and the problems with sound and the Internet.

**Theme 1. Video:** Some participants' priority in mentioning the problems occurring in class was the fact that most of the videos were in English and they had difficulty understanding.

Some of the participants (e.g., PS3, CS1 AND CS8) suggested that since the videos were in English, Turkish videos should be shown or the English videos should be translated into Turkish.

The sound problems with the videos caused issues with watching the video. Some of the participants pointed to the sound problem as a second issue and made some suggestions. CS5 said that there was a problem with the video sound at the beginning but that this was resolved later. CS9 suggested that an additional loudspeaker be used for the laptop. As a third problem, the participants spoke of the quality of the video image. Some of them

**Table 6.** Frequencies of themes and sub-themes related to the views of the constraints in the video-enhanced General Biology instruction, and suggestions.

Theme	Sub-theme	Some examples of quotations	P f	C f	T f
Video	Difficulties in understanding of videos in English	"... Some of the videos were not comprehensible at first look because they were in English. We were trying to understand by looking at the images." (CS1)			
		"... We watched some Turkish videos but they were mostly in English. The teacher translated the ones in English for us and it was enough just to listen to what the teacher said. Since we know the subject already, when the teacher explains it to us we learn some more." (PS3)	3	3	6
	Videos should be in Turkish.	-	1	4	5
	Sound problems in the videos	"... Sometimes there was no sound [from the video] ..." (PS7)			
		"The sound on some of the videos wasn't synchronized ... Looking at it [video] and following it without sound was better than having you teach the class." (PS4)	4	2	6
	Video should be muted during the lesson; an additional loudspeaker should be used.	-	1	1	2
	Problems in the quality of the video images	-	1	2	3
	Problems in the sequence of the videos, wasting time to look for a new video on Internet	-	-	2	2
	Videos should be downloaded before the class, students' choices of videos should be asked.	-	-	4	4
	Internet	Problems of slow Internet connections, slow opening or streaming of videos and getting cut off Internet.	"... There were times when there was no Internet connection ..." (PS7)		
"... We experienced problems with Internet speed. The videos were slow to open." (PS8)			5	4	9
		"The biggest problem was the speed of the Internet connection. When we were watching on YouTube, the videos were interrupted ..." (CP5)			
The university should resolve Internet speed issue.	-	2	2	4	

P: Physics Teaching; C: Chemistry Teaching; T: Total.

(e.g., PS7 and CS2) talked about a problem with the quality of the video images. In connection with this, CS1 said that the quality of the video image had to be improved.

Two prospective chemistry teachers (CS3 and CS6) stated that there were problems with the order in which

1194 Educ. Res. Rev.

the videos were being watched and also that it was difficult finding a new video for the class. Of these participants, CS3 said that this problem had subsequently been resolved. One of the participants in chemistry education (CS7) said that time was wasted in the attempt to find a video over the Internet during the class period; the participant did not however offer a suggestion regarding this issue. CS2 made the suggestion that the videos to be watched in class should be downloaded beforehand and CS3 said that the participants' opinions should be taken as to which videos they wanted to watch.

Moreover, PS1 said that they got bored when the video took as long as 15 min but that since the instructor let them watch only some parts of the videos, this was not a problem. CS6 and CS8 said that the number of videos watched in class were too many and suggested that there could be some more videos with more narrative content.

As a result, the most frequently mentioned problem that the participants pointed to was that the videos were in English. On the other hand, there were the participants that thought that this was not a problem since the instructor was translating the videos for them. While the participants called attention to the problem of sound in the videos, they also said that since the videos were watched on mute, this did not constitute much of a problem for them. The participants identified the quality of the image and the order of the videos as problems and said that these issues should be addressed.

*Theme 2. Internet:* Almost half of the participants spoke about a problem with the speed of the Internet connection. For example, PS7, PS9, CS2, CS5 and CS7 were among those that mentioned that while the lesson was being taught with the help of a video, the videos were slow to appear because of the problems with the speed of the Internet. PS6, PS7 and CS9 among other participants stated that the school should solve the problems of connectivity and Internet speed. PS9, stating that the videos were slow to open because of the problems with Internet speed, wanted the instructor to be aware of this.

Consequently, the participants spoke about problems with Internet speed and emphasized that the school should resolve these issues.

Some participants had suggestions about the research assignments. Some participants suggested that it would be better if General Biology course topics were handed out to the participants at the beginning of the term before the presentations and video research assignments were given to the participants. They stressed that when the presentations assignments were handed out, the subject limitations should be better delineated. Of the participants, PS6 said that the number of videos should be increased and that the participants should do research and make their own videos. Among the suggestions made about teaching the lesson with the help of videos, those of PS2 and CS3 were quite interesting:

... We can find our own videos and present these in

class. Since we're studying teaching, our abilities to lecture may develop in this way ... When we become teachers at a school, we may have to substitute as a teacher in some other course. (PS2)

... If the topic headings could be given to the students at the beginning of the term, and the students did research on the topics, it would be so much better if they prepared for class beforehand ... If students could find videos, study them and bring them to class, it would be more effective ... (CS3)

To sum up, the participants spoke mostly about the videos being in English, the sound problem, and also about issues related to Internet connectivity. Their comments about the video-enhanced lessons were mostly that the videos should be in the Turkish language, that video sound and images should be improved, and that the order of watching the videos should be determined beforehand. The issue that the participants pointed out the most was the need for the school to remedy the Internet situation. In addition, some of the participants suggested that the topics be determined at the beginning of the term, that the participants be given their research assignments on the basis of these topics, and that the participants be allowed to find their own videos to present to the class.

## DISCUSSION

In the study, many of the prospective physics and chemistry teachers had common opinions about the video-enhanced General Biology instruction. As we examine the results in detail, the following points can be made.

The expectations of the prospective physics teachers in the General Biology courses were mainly related to learn about themselves and environment/nature, to examine plants and animals, to learn what they contributed to nature and what nature contributed to them. The prospective chemistry teachers mostly expected to eliminate deficiencies, to reinforce what they had learned, learn new things, and to find out useful information about life in general and daily life. Videos took place 60-75% in General Biology courses according to most of the participants. Other techniques of handing out research assignments, trips/observations, laboratory work and providing examples from daily life were also employed. Most of the participants' expectations were both that the videos would facilitate their understanding of the lessons and that they would be better able to remember the class work. The General Biology courses were taught with the help of the videos in general, and the techniques of discussion and, question and answer were also used in classes. While the prospective chemistry teachers stressed that the videos demonstrated looking through a microscope at cells and cell organelles, bacteria, mitosis and meiosis, the prospective physics teachers empha-

sized that the videos on daily life demonstrated plants, animals, photosynthesis and deterioration.

Many of the participants' opinions were similar about the contributions of the videos to General Biology classes. The video-enhanced General Biology instruction increased the participants' interests in the courses, while also increasing their retention and ultimately contributing to their learning process. In other words, the participants' expectations of learning at the beginning of the course were met by the video-enhanced General Biology instruction. Therefore, videos can be used as teaching aids in Biology classes.

These results are consistent with the findings of the studies of Başaran and Gönen (2012), Esgice et al. (2012), Pekdağ and Maréchal (2007) that showed that video study materials or films enhance student learning and increase their interest in the course. Pekdağ and Le Maréchal (2010) assert that movies are useful in cognitive (learning more and better, memorizing, remembering) and psychological (motivation, pleasure of learning, etc.) learning in chemistry education. Similarly, Dulaney and Barrett (2004) explained that they used short feature film clips related to the students' class topic concluding that students enjoyed the course and the videos helped them to learn. In addition, computer-assisted instruction material on understanding photosynthesis (Taş et al., 2006) and a software course program were effective to remedy misconceptions in some biology concepts (Kara and Yeşilyurt, 2008).

According to the study results, it was also worth noting that almost half of the participants noted that they had no problem and they were satisfied with the video-enhanced General Biology instruction. However, videos in English language were the main problem indicated by the participants; sound and quality of the images in videos, sequence of the videos, wasting time to look for a new video on Internet during the course were the other problems. Actually, the videos in the English language were used in class more than the Turkish ones, since it has been observed on the Internet that the number of videos suitable for General Biology I and II in Turkish language is less than English videos. Videos in English language was not problem for some participants were not a great problem since the instructor translated the videos in English to Turkish or they were shown in class, summarized and the subject was discussed in the classroom. In the study the participants also suggested that Turkish language videos be used in class or that the English videos be translated into Turkish. As a result, there is a need for more Turkish university-level video clips related to concepts in biology (Yakar, 2013) or as an alternative, English videos can be translated into Turkish. The author of the current study assigns the students in Materials Development and Instructional Technologies class at Necatibey Faculty of Education in Balikesir University the duty of making video clips on various topics in biology. Some of the video clips are related to

the experiments carried out in biology laboratories. Videos used in laboratory courses can provide more autonomous learners, more time to pool and analyze class data, demonstrators' time being used for higher-level interaction with students, and the production of reusable learning materials for practical implementation (Crocker et al., 2010).

To download videos or video links and Internet connections were the other problems determined in the present study. The participants suggested that the faculty could resolve Internet speed issue, videos should be downloaded before the class, and students' choices of videos should be asked. Başaran and Gönen (2012) also reported there were problems about the lack of opportunity to access the Internet during out-of-class hours and the students' computers.

In connection with the results of the current study, in the years following the academic year 2011-2012, various changes were made in the method of teaching the General Biology I and II courses. For example, care was taken to ensure that videos to be shown in class were downloaded beforehand. The students were asked to download videos before class. In this way, the problems experienced with making the videos available to class were overcome. All of the Internet lines were also revamped at Balikesir University over the period 2013-2014 and because a conversion was made to a wireless network system, it is believed that much of the problems with Internet connectivity and video downloading have also been overcome.

To conclude, the video-enhanced General Biology instruction was found much more comprehensible and entertaining by the participants, because videos appealed to both audio and visual senses. In similar to the finding of the current study, Karamustafaoğlu et al. (2012) stated that the participants liked Vitamin software program used in the Science and Technology courses, however they brought up the negative points that there were too few activities and tests, the program had no question-asking feature, and that the existing questions were too easy. Brecht (2012) demonstrated that online video lectures facilitated to understand topics compared with the other techniques. It is therefore understood that video-enhanced instruction may be used at different class levels in Biology courses. Videos can be shown during the courses even after the end of the course. If videos play lists are provide to the students, they can have an opportunity of reviewing and reliving the experience of the course (Crocker et al., 2010).

On the contrary, in the studies by Taşçı et al. (2010) and Kahyaoğlu (2011), it is reported that although technological tools are now more commonly available at schools, Science and Biology teachers are not using these new technologies. Fancovicova et al. (2010) also indicated that the increase in computer hardware at the schools does not mean that technology is being adequately used in Biology courses. Teachers should be

more competent in using educational tools such as websites, videos and animations more effectively in biology courses. In order to take full advantage of videos, and information and communication technologies, teachers and other users need to increase their knowledge and skills about how to integrate these tools into the classroom (Başaran and Gönen, 2012; Kellam, 2010; Pekdağ and Maréchal, 2007; Zhanga et al., 2006). Moreover, to review English videos or websites, one must have a reasonable knowledge of the English language. It is for this reason that it would be useful for users and particularly teachers to organize pre-service training courses for learning English and also for becoming familiar with using information technologies (Altunoğlu and Atav, 2005; Yeşilyurt and Gül, 2008).

The final suggestion for the future studies is that several instruments such as questionnaire, observation form or achievement test can be used to provide a deeper insight into study beside interview form.

### Conflict of Interests

The author has not declared any conflict of interests.

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- "Bread mold," YouTube video, 0:24, <http://www.youtube.com/watch?v=PXwLddA4Ctw&feature=related>
- "Budding yeast," YouTube video, 5:31, <http://www.youtube.com/watch?v=BTHYaf-EuYs&feature=related>
- "Büyük ve küçük kan dolaşımı oyunu (Game of pulmonary circulation and systemic circulation)," Fen Okulu Net Video (Science School Web video), 3:10, <http://www.fenokulu.net/portal/Sayfa.php?Git=KonuKategorileri&Sayfa=KonuvideoListesi&baslikid=63&videoNo=1317>
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- "Phototropism in tomatoes-Timelapse," YouTube video, 0:18, <http://www.youtube.com/watch?feature=endscreen&v=Ze8NV7cvW8k&NR=1>
- "Reproduction in fungi," YouTube video, 2:05, <http://www.youtube.com/watch?v=qDwgSWDqKQ&feature=related>
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Program," May 10, 2011,  
<http://www.youtube.com/watch?v=F7tVnQ4tVKk&feature=related>  
"Time lapse movie of mould growing in a tea cup", YouTube video, 0:39,  
[http://www.youtube.com/watch?v=O\\_v4UXHFd00&NR=1&feature=endscreen](http://www.youtube.com/watch?v=O_v4UXHFd00&NR=1&feature=endscreen)

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## APPENDIX A. Examples of Turkish and English websites and biology videos used in general biology I and II courses

- *The websites used for biology videos in Turkish for General Biology I and II courses:*  
*Türkiyenin Fen ve Teknoloji Sitesi (Website of Turkish Science and Technology)*, 2002. Web. 28 May 2012. <http://www.fenokulu.net/>.  
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- *The websites used for biology videos in English for General Biology I and II courses:*  
*YouTube*, Feb. 2005. Web. 28 May 2012. <http://www.youtube.com>.  
*TeacherTube*, 6 March, 2007. Web. 28 May 2012. <http://www.teachertube.com>.  
*Dailymotion*, French Limited Firm (Anonym Firm), 15 March 2005. Web. 28 May 2012. <http://www.dailymotion.com/tr>.
- *Biology videos in Turkish for General Biology I and II courses:*  
Uzun, Orçin. "Besinlerin Oksitlenmiş Kalıntısı BOK (Oxidized Waste of Foods SHIT)," YouTube video, 9:22, March 16, 2010, <http://www.youtube.com/watch?v=DQOz8p1e-4>.  
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"Büyük ve küçük kan dolaşımı oyunu (Game of pulmonary circulation and systemic circulation)," Fen Okulu Net Video (Science School Video), 3:10. <http://www.fenokulu.net/portal/Sayfa.php?Git=KonuKategorileri&Sayfa=KonuvideoListesi&baslikid=63&videoNo=1317>.
- *Biology videos in English for General Biology I and II courses:*  
"The Six Kingdom Classification: Part 1, Animals, Plants, & Fungi," YouTube video, 4:08, posted by "Described and Captioned Media Program," May 10, 2011, <http://www.youtube.com/watch?v=F7tVnQ4tVKk&feature=related>.  
"Bacteria Multiplying," YouTube video, 0:15, <http://www.youtube.com/watch?v=zrx7Xg0gkQ4&feature=related>.  
"Budding Yeast," YouTube video, 5:31, <http://www.youtube.com/watch?v=BTHYaf-EuYs&feature=related>.  
"Reproduction in Fungi," YouTube video, 2:05, <http://www.youtube.com/watch?v=qDwgSwdQKoQ&feature=related>.  
"Bread Mold," YouTube video, 0:24, <http://www.youtube.com/watch?v=PXwLddA4Ctw&feature=related>.  
"Time Lapse Movie of Mould Growing in a Tea Cup," YouTube video, 0:39, [http://www.youtube.com/watch?v=O\\_v4UXHFd00&NR=1&feature=endscreen](http://www.youtube.com/watch?v=O_v4UXHFd00&NR=1&feature=endscreen).  
"Phototropism in Tomatoes-Timelapse," YouTube video, 0:18, <http://www.youtube.com/watch?feature=endscreen&v=Ze8NV7cvW8k&NR=1>.
- *Examples of animations in Turkish or English for General Biology I and II courses:*  
Zülal, Aslı. "Hücreye yolculuk (Journey to cell)". TÜBİTAK Bilim ve Teknik Websitesi (Website of Science and Technology), 2002. Web. 28 May 2012, <http://www.biltek.tubitak.gov.tr/bilgipaket/hucre/01.swf>.  
Boe, Dana. "The Annoying Orange 3: TOE-MAY-TOE". Daneboe/Gagfilms 2nd Channel, YouTube video, 2:11, Dec. 4, 2009, <http://www.youtube.com/watch?v=xjdBCeUdAml&feature=relmfu>.