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Why and How Astronomy Education in Socıal Studies

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ABSTRACT

Individuals can only contribute to their society and humanity to the extent that they can shape the future. In this case, it can only be achieved by incorporating a versatile science such as astronomy, the foundations of which were laid with the first human being, into the education-teaching processes. The effort of individuals to understand, discover and recognize the sky has been an important effort for centuries. In this case, it provided the birth of the science of astronomy. With astronomy education, individuals gain creativity and scientific thinking, the relationship between time and location, and the ability to make realistic and scientific decisions. In this context, the aim of the study is to theoretically reveal the place and necessity of astronomy in social studies lesson and how astronomy education can be carried out. In addition, the study also revealed the relationship between social studies and astronomy, and as a result, it offered suggestions to social studies teachers and prospective teachers about what to do to teach these subjects.

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Sosyal Bilgilerde Neden ve Nasıl Astronomi Eğitimi

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ÖZET

Bireyler ancak geleceği şekillendirebildikleri ölçüde toplumlarına ve insanlığa katkı sağlayabilirler. Bu ise temelleri ilk insanla birlikte atılmış olan astronomi bilimi gibi çok yönlü bir bilimin eğitim-öğretim süreçlerine dâhil edilmesi ile olabilir. Bireylerin gökyüzünü anlama, keşfetme ve tanıma çabası asırlar boyu önemli bir uğraş olmuştur. Bu durumda astronomi biliminin doğmasını sağlamıştır. Astronomi eğitimiyle birlikte bireyler, yaratıcılık ve bilimsel düşünmeyi, zaman ve konum arasındaki ilişkiyi ve gerçekçi ve bilimsel temellere dayalı kararlar verebilmeyi kazanmaktadırlar. Bu bağlamda çalışmanın amacı sosyal bilgiler derslerinde astronominin yerini, gerekliliğini ve astronomi eğitiminin ne şekilde gerçekleştirilebileceğini kuramsal olarak ortaya koymaktır. Ayrıca çalışmada sosyal bilgiler ve astronomi konularının ilişkisi de ortaya konulmuş ve sosyal bilgiler öğretmenleri ve öğretmen adaylarına bu konuların öğretilmesi için neler yapması gerektiğiyle ilgili öneriler sunmuştur.

Anahtar Kelimeler: Astronomi Eğitimi, Sosyal Bilgiler Öğretimi, Bilim Teknoloji ve Toplum, Bilimsel Okuryazarlık.

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Introduction

Almost all societies in human history have been interested in the sky, stars or planets; in other words, astronomy, one of the oldest sciences in history. Human beings have always been interested in astronomy because they wanted to make sense of what was happening around them and to find answers. For this reason, since the first human beings, societies have made various studies about the sky, knowingly or unknowingly. At first, people were contented with making explanations about the universe thanks to the observations they made with the naked eye and tried to obtain data by completing this information in their minds. In the following periods, they started to acquire scientific knowledge about the universe with advanced technology and knowledge.

Astronomy has had a special place in terms of contributing to the development of the civilizations established by the first people. Knowledge, which was previously shaped around the basic needs for survival, is now considered as power. In addition to the information that would enable survival, topics such as comets, meteorites, the movements of the sun, the earth and the moon attracted the attention of the first people and increased their sense of curiosity. It can be said that this interest and curiosity actually arose from people's fears and after a while progressed as fear and reaction to the unknown. However, over time, this fear gave way to reality; they tried to benefit from astronomy in matters such as classifying the seasons, finding directions, preventing floods and calculating time. Thus, the foundations of the science of astronomy were laid, and as frightening and scary events were solved, they were replaced by positive science (Tez, 2021, p. 9; Topdemir & Unat, 2009, pp. 171-172). Astronomy (Düşkün, 2011), which is an interdisciplinary science that examines celestial bodies from different aspects and can be changed and updated in line with the scientific knowledge obtained, is not static and has constantly accumulated and progressed over time (p.39). The science of astronomy, which has developed and changed over time, has caused humanity to leap in size with new information and developing technology (Limboz, 2022). As important as the sky and space were for humans thousands of years ago, it is seen that this importance continues to increase today. What do the sky and space mean to humans? Why are black holes important? Why do we land spacecraft on meteorites, why do we need to study supernovae, and why do we search for new worlds? The answers to all these questions can be explained by curiosity, the sense of discovery and the desire to survive. These and similar questions and the desire to find answers to them are increasing the investments and importance given to astronomy.

Developments in science and technology have increased interest in space, accelerated developments in basic sciences and made astronomy education compulsory for individuals to lead the age (Emrahoğlu & Öztürk, 2009, p. 166). Astronomy education is considered important in terms of education because it includes features such as approaching non-scientific situations critically and questioningly, ensuring and improving the relationship between theory and practice (European Association for Astronomy Education [EAAE], 1994). Roche, Roberts, Newsam, and Barclay (2012) state that astronomy-related topics are among the most interesting, frightening, and inspiring topics in educational programs and that these topics have a high power to motivate students (p.69). When the national and international literature was examined, it was determined that astronomy education is given in relation to science (Krumenaker, 2009; Brogt, 2007; Chastenay, 2018; Kurnaz, 2012; Fraknoi, 2014; Ünal & Bozdoğan, 2021; Giacconi, 2005; Ros & Garcia, 2019; Taner, Esenoğlu, Unat, Özışık & Kırbıyık, 2020; Prather, Rudolph & Brissenden, 2009; Proshletsova & Perov, 2006; Bretones, 2019; Timur, Yalçınkaya-Önder, Timur & Özeş, 2020; Roche, Roberts, Newsam & Barclay, 2012; Bektaşlı, 2014; Percy, 2006; Marusic & Hadzigebovic, 2018; Taşcan & Ünal, 2015; Karaçam, Yener, Canbazoğlu-Bilici, Şahin Çakır & Yürük, 2022; Çiv, Saka & Koray, 2022; Kaya, 2018; Karamustafaoğlu, Bolat, Kaşıkçı & Değirmenci, 2016; Oğuzman, Metin & Kaya, 2021; Albayrak, 2016; Sarıoğlu, 2022; Taşcan, 2013; Saka, 2018; Türk, 2018; Küçüközer, Bostan & Işıldak, 2010; Göncü, 2013). It is usual for studies on astronomy education to be associated with science because of the content of the related lensons. However, it is quite normal to associate astronomy education with the social studies lesson. This is because social studies is a lesson

based on topics of interest to the individual and society, and throughout human history, topics related to astronomy have both attracted the attention and aroused the curiosity of individuals and societies. When the 2005 and 2018 social studies curricula are examined, it is seen that scientists who contributed to science in the field of science, technology and society learning are included and some of them have studies related to astronomy (Ministry of National Education [MEB], 2005, 2018). However, it can be said that astronomical issues have not gone beyond theoretical understanding. However, today's world is associated with complex and globalized problems. Social studies equips individuals to think deeply and critically about local, national and global problems. This enables individuals to cross geographical boundaries, apply scientific and mathematical analysis to historical questions and current issues, appreciate cultural diversity, and experience events by examining primary sources (New Jersey Student Learning Standards [NJSLS], 2020, p. 2). How can these qualities, science, mathematics, current issues, primary sources, and geographical borders be used together to contribute to the rethinking and redesign of social studies? In this context, astronomy education, which embodies these qualities, is very important. In many developed countries, astronomy education is either an independent lesson or a tool that is included in the content of lessons such as science and is used to provide individuals with many characteristics (Karamustafaoğlu, Bolat, Kaşıkçı & Değirmenci, 2016, p. 388). For this purpose, astronomy education;

- "To raise public awareness of the science of astronomy,
- To arouse a sense of curiosity in students about scientific events by using scientific methods,
- To teach to approach some problems encountered in daily life in terms of basic sciences,
- To teach students the historical development of astronomy, the oldest of the basic sciences
- To give students the habit of scientific research and examination, to develop the ability to comment on the results
- Developing creativity and scientific thinking
- Developing the ability to think in three dimensions
- To provide an understanding of the relationship between location and time
- To teach the rapid technological developments in astronomy and how they interact with basic sciences
- To gain realistic and scientifically based ideas about whether there is life in the universe outside the Earth
- To enable students to acquire the skills to construct new knowledge through research, reading and discussion
- To enable them to use appropriate scientific processes and principles when making personal decisions" (MEB, 2010, p. 3).

Considering these objectives, astronomy education aims to make students comprehend the universe and the world and gain a basic astronomical point of view, develop the habit of using social sciences in concrete events, gain scientific thinking skills, and understand the connection between space sciences and technology. From this point of view, it is possible to say that the content of astronomy and social studies lessons overlap. In this context, it is quite natural that astronomy subjects or, in other words, astronomy education should be included within the scope of the social studies lesson when the objectives of the social studies lesson are taken into consideration.

Aim of the Study

The aim of this study is to theoretically reveal the place and necessity of astronomy in social studies lessons and how astronomy education can be realized. In line with this main purpose, the following questions were sought to be answered:

1. What is the place of astronomy education in social studies lessons?
2. Why should astronomy education be given in social studies lessons?
3. How should astronomy education be realized in social studies lessons?

The Place of Astronomy Education in Social Studies Lessons

In today's world, where scientific and technological developments are rapidly diversifying and many developments are taking place, one of the most important factors for nations to survive is effective and quality education. One of the most important reasons for this situation is that the generations to be raised are one of the factors that will shape the future. In this context, it is aimed to raise individuals who are in line with the requirements of the age, who shape the future, who can use science and technology effectively, who are productive, modern, productive citizenship skills, who can solve problems, who recognize and shape their environment and the world. It can be said that all these qualities are parallel to a society's understanding of raising scientists. At this point, it reveals the importance of the social studies lesson, one of the aims of which is to train social scientists.

Social sciences constitute the content of social studies lessons and these social sciences include history, geography, law, political science, anthropology, philosophy, sociology, social psychology, art history (Garcia & Michaelis, 2001, pp. 25-26; Sunal & Haas, 2005, pp. 10-11) and astronomy science also benefits from these social sciences. In this context, social studies, which is an effective tool in shaping the dynamics of society, has many definitions in the literature. Moffatt (1957) defined social studies as human knowledge since its subject matter directly emphasizes the relationship between man and society, its development and the whole of relationships that directly concern man (1-8). MEB (2005) defines social studies as "a primary education lesson that reflects social sciences such as history, geography, economics, sociology, anthropology, psychology, psychology, philosophy, political science and law, and civic studies in order to help the individual realize his/her social existence; includes the combination of learning areas under a unit or theme; examines the interaction of human beings with their social and physical environment in the context of the past, present and future; and is based on a collective teaching approach" (p. 2). Finally, the National Council of the Social Studies (NCSS) defines social studies as a field of study consisting of the integration of social sciences, arts and literature with an interdisciplinary approach in order to gain the necessary citizenship competencies (Safran, 2014, pp. 3-5). Based on these definitions, it can be said that social studies is a lesson taught in grades 4-7 that enables individuals to gain the ability to use critical, innovative and scientific thinking by utilizing social science disciplines, the effects of science and technology on social life, and the ability to use technology to access scientific

knowledge. In addition, according to MEB (2018), social studies also offers the individual the competence to comprehend citizenship responsibilities and to understand situations arising from changes (p. 5).

Like all scientific disciplines, the isolation of astronomy from educational activities is contrary to the understanding of education in our age. Because astronomy is a field that has been guiding life and humanity since the first humans, where multiple disciplines have the opportunity to work together. Considering the importance of astronomy, it is understood how important the education of this science is.

Astronomy has a close relationship with many social sciences. This is evidence that the technological developments in our age, especially the discoveries in astronomy, can be evaluated with multiple social sciences. Although directly related to science and mathematics, astronomy is also related to social sciences such as geography, philosophy and sociology. According to Marusic and Hadzigebovic (2018), the reason for this relationship is that it increases the welfare level of nations and the organic connection between the individual and the universe (62-63).

In today's world, astronomy is an important subject for individuals and this science is advancing at a dizzying pace every day. With these developments in technological and scientific developments, individuals can now dream of living on Mars, observe space and galaxies with advanced instruments, and conduct studies for different purposes. According to Karamustafaoğlu, Bolat, Kaşıkçı & Değirmenci (2016), developments in the science of astronomy are very important because it is thought that the first starting point of the developments that have or will take humanity to a new dimension is the developments in this field. In order to be a party to these developments, effective astronomy education should be provided starting from an early age. Individuals can gain scientific thinking skills through astronomy education. In this direction, astronomy education should be provided not only in science but also in other lesson from an early age (p. 388).

Astronomy enables a better understanding and exploration of the universe and celestial bodies. Just as it is necessary to understand the science of history in order to understand the past and give direction to the future, astronomy must be well known in order to recognize and understand the universe (Taşcan & Ünal, 2015, p. 26). The interest in astronomy is increasing day by day and this situation reveals once again how important astronomy education is. On the one hand, to better understand and comprehend the universe, and on the other hand, the effort to find a new "world" has a serious impact on this situation (Marusic & Hadzigebovic, 2018, p. 63).

The importance of 21st century skills is more prominent in today's educational approaches. In addition to high-level skills such as critical thinking, creativity, observation, research and problem solving, it is important for students to provide the necessary equipment in raising scientifically literate individuals

(Aydeniz, 1997, p. 6). Considering the nature of astronomy science, it is seen that the importance of gaining these key points to individuals once again emerges. In this context, there is a need for effective and qualified astronomy education.

Why Astronomy Education in Social Studies Lessons

Why do we teach astronomy? In fact, we can trace the answer to this question back to the activities of the first civilizations to make their lives easier. According to Percy (1998), astronomy culture should be an integral part of education because of its philosophical importance and its decisive impact on all societies (pp. 3-4). Beyond its contribution to the development of science, astronomy helps human beings understand their place in space and time and the situations affecting the Earth (Timur, Yalçınkaya-Önder, Timur & Özeş, 2020, p. 383).

According to Ros and Garcia (2019), astronomy topics have been included in curricula for centuries and have been used to increase individuals' interest in science (p. 476). Through astronomy education, individuals can acquire skills such as research, perception of time and chronology, critical thinking, perception of change and continuity, observation, use of evidence and location analysis, and values such as scientificity and diligence. These skills and values are also included in the social studies curriculum (MEB, 2018, p. 9). Therefore, it can be said that social studies and astronomy overlap in terms of gaining skills and values. In addition, astronomy science is an important element that contributes to the conceptual world of individuals (Trumper, 2006, p. 881). Through astronomy education, individuals can gain concepts such as latitude, longitude, meridian, parallel, ellipse, geoid, geoid, earth axis, equator, coordinate system, local time, absolute position and relative position. It is seen that these concepts overlap with the learning areas in social studies. Therefore, it can be said that astronomy education and social studies lesson have similar characteristics that can be utilized in teaching abstract concepts to students.

According to Hacısalihoğlu (2006), astronomy is a science that is located at the intersection of other sciences and provides important information to individuals about the understanding of the universe, is related to social sciences as well as science and mathematics, and is considered important in terms of contributing to the intellectual world of the individual. In this respect, astronomy's relationship with science and technology as well as its pioneering role in scientific developments have attracted the attention of educators and revealed the necessity of presenting this science to individuals as an educational discipline (Karaçam, Yener, Canbazoğlu-Bilici, Şahin Çakır & Yürük, 2022, p. 73). According to Percy (2006), the process that started with Edmond Halley's or Isaac Newton's studies formed the basis of today's space studies, and both paved the way for science and increased social and technological interest in astronomy with the impact of these studies, and the relationship of astronomy with science and its contribution to engineering has also affected technology and education (pp. 248-

250). This shows that astronomy should not only be evaluated in terms of science, but should be included in every layer of educational activities.

Osborne and Collins (2000) conducted a study with students and their parents in the UK and found that among science and technology topics, astronomy-related topics attracted the most attention. Astronomy stimulates curiosity, imagination and a sense of discovery, and can also serve as an amateur hobby (p. 9). The science of astronomy is appealing and can be used to engage and interest young children in science.

According to Trumper (2006), astronomy education is seen as a factor that provides changes in students' conceptual structures. This feature of astronomy science has drawn attention to the necessity of astronomy education in curricula and international conferences have revealed that astronomy education must be included in curricula (p. 880).

Astronomy education is of great importance for individuals because this field embodies the basic building blocks of science, such as establishing connections between theory and practice, and approaching non-scientific elements with questioning and skepticism (EAAE, 1994). With the development of technology and the increase in space-related studies, developments in basic sciences are gaining momentum and scientific developments are occurring at a pace never seen before in history. In this case, it is considered remarkable in terms of catching up with the age and guiding technology (Emrahoğlu & Öztürk, 2009, p. 166). Increasing their knowledge and awareness about astronomy is also important for young people and children in choosing a profession. It is thought that young people who choose a profession related to astronomy can achieve significant success on behalf of their countries in today's space and technology age.

In a study conducted by Percy (2005), the reasons why astronomical science is useful and why it should be included in curricula were revealed. The science of astronomy should be included in curricula because it is related to the fields of culture and history, practice, science and technology, aesthetics and emotion, education and society (p. 12). All these qualities contribute to the development and progress of humanity. From an educational perspective, astronomy can be used to teach and develop scientific methods in the classroom. It is seen that the concepts emphasized by Percy (2005) overlap with the content and objectives of the social studies lesson.

According to Percy (2005), astronomy education allows human beings to realize their place in time and space, to witness solar eclipses by opening the door to a vast universe, to feel the excitement of seeing a black hole, and to imagine the beauty of the night sky (pp. 10-13). Astronomy is directly related to life itself, as it is concerned with the formation of our daily lives. With astronomy, human beings began to question their own existence and tried to find answers to the question of where and how they came from in the incredible infinity of the sky (Rosenberg, Russo, Bladon & Christensen, 2013, p. 1). If astronomy

is taught with the right educational model, it can promote scientific thinking and understanding of the nature of science (Karaman & Apaydın, 2013, p. 843). In this case, it allows individuals to become effective scientific literates. Considering that it is an interdisciplinary field, it is thought to contribute to the academic careers of individuals by establishing interdisciplinary connections (Tunca, 2000).

How to Study Astronomy

Especially in the teaching of abstract topics, both teachers and students have problems. According to Prather, Rudolph, and Brissenden (2009), although astronomy topics are interesting and intriguing, they also include abstract topics (p. 41). So what can be done to overcome this situation? How can the classroom environment and methods-techniques, materials and most importantly processes be guided or managed?

According to Bektaşlı (2021), the science of astronomy continues to be as popular today as it was in the past. In addition to this popularity, it also has an effect that facilitates the life of the individual. However, it is seen that astronomy education has been ignored for many years in both science curricula and other teacher training programs (p. 306). However, with the recent regulation, both science programs were renewed and other teacher training programs were revised according to the requirements of the age, and within this framework, the social studies undergraduate program was also revised (YÖK, 2018). Astronomy is a science that pushes the boundaries of science and offers the opportunity to work with both social sciences and science. Due to its unique structure, it also includes topics related to many lesson. One of the lesson with which it has established close relationships is the social studies, where the development of science and technology and its reflections on society are conveyed to individuals. According to Ros and Garcia (2019), astronomy education includes many disciplines such as sociology, psychology, geography, history, and sociology, and provides individuals with intriguing topics (p.477). This shows that social studies and astronomy are fed by common areas.

According to Ros and Garcia (2019), astronomy education develops inference and prediction skills in individuals (p. 478). For example, calculating the orbital plane or predicting where on Earth the satellite launched by the People's Republic of China will fall out of control. This will contribute to the individual's motivation to learn with extraordinary phenomena and bring a breath of fresh air to the social studies lesson. This is also a good example of the use of current events in social studies. From this point of view, astronomy is a discipline related to social studies with its current issues.

According to Percy (2005), astronomy education was presented theoretically in the past. However, with the developing technology and scientific understanding, this understanding has changed and educational activities have gone out of the classroom. Now, individuals can access information and phenomena related to astronomy with sufficient equipment whenever they want (pp. 12-13). Astronomy education also offers a lesson content in which rich visuals can be provided to individuals (Prather, Rudolph &

Brissenden, 2009). If a lesson is supported by visuals, of course it will be interesting and this will increase individuals' interest in the lesson. Another advantage of astronomy education is that, unlike other sciences, there is a sky above every school. Thus, it offers the opportunity to do science very easily with the help of qualified teachers without the need for advanced observation instruments (Ros & Garcia, 2019, p. 479). Astronomy education also contributes to the mystery and philosophical perspective of humanity, providing quality information about past life in the midst of the unknown. This knowledge guides the future and helps individuals to be motivated to take this science further (Trumper, 2006, p. 884).

Space and the sky, which the individual is most interested in and tries to solve and explore, is a wide field of research (Yavuz, Saka & Koray, 2022, p. 501). In this context, establishing connections between phenomena related to astronomy, examining events and phenomena from different perspectives, and interpreting the movements of objects in multidimensional space provide competence (Ünal & Bozdoğan, 2021, p. 2721). Topics related to astronomy constitute important sub-fields of social studies (YÖK, 2018, pp. 4-9-10; MEB, 2018, p. 24). In this context, the social studies lesson is a multidisciplinary primary and secondary school lesson that includes astronomy. In the global world, 21st century skills have been set as a target at all levels of education and the necessity of providing them to individuals has been emphasized (Çiftçi, Sağlam & Yayla, 2021, p. 719). The main goal here is to provide individuals with "learning and renewal skills, information, media and technology skills, life and career skills" (Kylonen, 2012, p. 6). The development of this skill group in the individual will also contribute to the formation of the type of individual needed by the period.

The main purpose of the social studies lesson is to raise effective and productive citizens (Barr, Barth & Shermis, 2013, p. 12). Considering the changing world conditions and circumstances, what types of citizens will there be in the future? What does it mean to be a space citizen? and what are the responsibilities of a space citizen? We frequently encounter such questions in written, visual and social media (URL-1). According to the futurist understanding, anyone who imagines a better world and strives for it is a futurist. To give direction to the future and to achieve this by using scientific methods explains the general aims of futurists. (URL-2). From this point of view, humanity will start living on other planets after a while and the understanding of citizenship will change in this context. With an effective astronomy education in social studies lesson, the understanding of citizenship in the new civilizations that are close to be established can be shaped and positive gains can be offered to social life on the axis of citizenship.

Result, Discussion and Recommendations

The world we live in covers a period in which it is difficult to follow the development of science and technology. New developments are taking place every second and these developments shape life and necessitate change. Where countries will take place in this change and development is shaped according to the vision and education programs they create. This will be done by transferring science and technology to future generations with an effective understanding that will shape the future. In this sense, increasing interest in science and technology will be possible with an effective social studies and astronomy education at an early age in order to form the minds that will shape the future. Trumper (2006) argues that astronomy education and astronomy-related subjects should be given to individuals at all levels of education (p. 881).

Astronomy education is recognized as an important tool for increasing interest and curiosity in science and technology. Through astronomy education, individuals learn abstract concepts and acquire the idea of doing science at an early age. According to Percy (1998), astronomy is based on an understanding that is necessary for the development of all countries, whether developed or undeveloped, which strengthens the feelings of curiosity, imagination and discovery, as well as an alternative approach to the scientific method (p. 3).

Social studies is a lesson in which many disciplines are presented to individuals simultaneously, including astronomy topics. It is necessary to enrich the social studies lesson with astronomy topics in order for it to take on a different understanding and to present it effectively to individuals. In addition, the social studies lesson also aims to train social scientists. With a social studies lesson blended with an effective astronomy education, the individual will acquire the characteristics that a social scientist should have. According to EAAE (1994), this is based on the ability of astronomy education to reflect the relationship between theories and experiments, to enable individuals to critically approach pseudoscience topics, and to incorporate scientific thinking methods. Considering all these results, the following suggestions can be made:

- Astronomy education should be offered to individuals starting from an early age. For this purpose, life science lesson should be included in the process. Since it contains many abstract concepts, it is thought that providing education in this science at least at the introductory level will be an important factor for the development of the country's economy in the future.
- Teachers have a great job for an effective astronomy education. The more they master the subject, the more developed individuals will be. For this reason, the quality of education can be improved through in-service trainings to be given to teachers.
- Teacher candidates can be trained more qualified. In the undergraduate program of social studies teaching, astronomy and astronomy-related subjects are offered to prospective teachers in different lesson contents such as General Physical Geography, History and Philosophy of Science, Physical Geography of Turkey, History of Recent and Recent Era, History of the

Middle Ages and Science, Technology and Society, but they can be given in a specialized way. These lenssons can be an introduction to astronomy or the teaching of astronomy topics.

- To increase interest in astronomy and space studies and to support their teaching, space corners and classrooms where astronomy studies can be carried out can be created for students and teachers.
- Research can be conducted on social studies teachers' and pre-service teachers' attitudes towards astronomy and their views on astronomy topics.

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