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Robot Programming Educational Studies in Turkey: A Content Analysis

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Abstract: The digital age requires basic computer use qualifications as well as coding skills for individuals to produce technology instead of using them. The programming education, which was previously at the undergraduate level, started to be given to students at high school and secondary school levels because of their contribution to problem solving, critical thinking and mathematical thinking skills of the learner. Due to the fact that programming education contributes to academic development, the result of the addition of education to education has been the low level of student success in programming education and the complexity of coding. In order to overcome the understanding of conceptual abstract sequences from coding difficulties, the teaching of the software of the concrete systems is emphasized, and the contribution of new fields of study such as game programming and robotics programming to education is discussed. This research is to describe the work done in Turkey on robotics programming; studies have been conducted to provide general information. For this purpose, academic research on robotics programming in Turkey was examined using content analysis.

Keywords: Robotics Programming, Digital Era, Software, Content Analysis.

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INTRODUCTION

Today, robots are used in many fields such as industry, health, space studies, agriculture, defense industry and highly successful results are obtained. The field of educational technologies, which is formed by using technology in educational sciences, covers the concepts of electronic learning (e-learning), mobile learning (m-learning) as well as robotic learning (r-learning). R-learning education service is defined by robots as learning or robot supported learning (Han, 2010).

Educational robots have been developed for R-learning in many countries, primarily in Canada, Japan, South Korea, Taiwan and America (Kim and Kim, 2011; Han, 2012). PEBBLES (Fels & Weiss, 2001) in Canada; ROBOVIE (Kanda et al., 2004) for primary English in Japan, PAPERO (NEC, 2012) for childcare, Keepon (Beatbots, 2007) for autistic children, Saya (Shuster, 2012) for preschool children; IROBI (Han et al., 2005), IROBIQ (Hyun et al., 2008) for preschool education in South Korea, ROTI and ENGKEY (Yonhapnews, 2009) and ROBOSEM (Park et al., 2011) for primary education English; ROBOSAPIEN for primary school English in Taiwan (You et al., 2006); In America, RUBI and QURIO (Movellan et al., 2005; Movellan et al., 2009) are used for preschool education, and VGO (Vgo communications, 2011) for young patients.

In studies on the use of robots in the field of educational technologies, subjects such as technology based learning, robotic assisted learning, use of robots in education and training, robot programming are studied. This research is to describe the work done in Turkey on robotics programming; studies have been conducted to provide general information. For this purpose, academic research on robotics programming in Turkey was examined using content analysis.

METHOD

In this study, content analysis method one of the qualitative research methods was used to analyze the educational studies robot programming in Turkey (Ekiz, 2003). The sample of study consists of the thesis, articles and proceedings conducted till the end of the 2019 in Turkey. The thesis database of the Council of Higher Education of Turkey and Google Scholar are databases used for constituting the sample population of this study.

The combination of the keywords “robot”, “programming” and “coding” were used to search studies. Following the search, 26 different educational studies were found on robot programming, while choosing these researches, the criteria of having an educational process and scientific evaluation of this process are taken into consideration. Publication Classification Form for Robot Programming was built on and used for recording data obtained from the studies addressing the concept of robot programming (Appendix A), developed by authors (Demirer and Erbaş, 2016).

Studies were analyzed on the basis of two faculty member agreement, in order to achieve validity and reliability studies for the content analysis process. Codes and categories were established

to determine the studies to be analyzed. The results were presented in tables and findings were interpreted.

FINDINGS

According to findings, the first educational robotics programming research was published in 2005. Number of the published researches between 2005 and 2019 analyzed in this study is 26, labeled P1 up to P26 in chronological order. A large part of the studies carried out was found to be a master's thesis and the number of studies has increased since 2016 (see Table 1).

It was determined that in the researches, robotics programming training was given to the participants in different types and periods. Types of the robot programming training event described as "robot club" (f=1), "robot competition" (f=1), "project" (f=2) and "education" (f=22). Durations of the events stated form 3 days to 8 months, that has been determined that it is generally more than 2 months. In addition to selecting the target group at primary level, there are also special group practices such as undergraduate students and gifted groups. The average number of participants is 41, and researchers working in private groups kept the number of participants low (see Table 1).

Table 1. General information about the researches

No	Type of the Event	Duration of the Event	Target Group	Number of the Participants	Publication Year	Publication Researcher
P1	Robot club	8 months	6-7. grade students	17	2005	Çavaş and Çavaş
P2	Education	16 weeks	8. grade students	40	2010	Çayır
P3	Education	8 weeks	7. grade students	40	2012	Koç Şenol
P4	Project	3 days	6-7. grade students	28	2013	Eraslan et. al
P5	Education	3 days	6-7. grade students	28	2013	Kılınç et.al
P6	Education	5 weeks	6. grade students	52	2013	Özdoğru
P7	Education	2 months	7. grade students	54	2014	Kılınç
P8	Education	10 weeks	8. grade students	40	2014	Okkesim
P9	Education	5 weeks	6. grade students	50	2016	Kuş
P10	Education	6 weeks	Undergraduate 2-3rd year students	15	2016	Silik
P11	Project	3 days	4-5-6-7-8. grade students	100	2016	Zengin
P12	Education	10 weeks	Preservice teachers	20	2017	Avcı
P13	Education	1 week	6-7. grade students	9	2017	Çankaya, Durak and Yünkül
P14	Education	7 weeks	10. grade students	43	2017	Çukurbaşı
P15	Robot competition	3-4 months	7-8-9. grade students	15	2017	Dönmez
P16	Education	5 weeks	5-6-7-8. grade students	58	2017	Kasalak
P17	Education	4 months	Preservice teachers	27	2017	Küçük and Şişman
P18	Education	8 weeks	11-14 age group	21	2018	Dizman
P19	Education	10 days	13-14 age group	7	2018	Kırkan
P20	Education	2 months	8-10 age group	15	2018	Pakman
P21	Education	1 month	5-6. grade students	60	2018	Şimşek
P22	Education	12 weeks	5-6 age preschool	24	2018	Türe

			education students			
P23	Education	8 weeks	8. grade students	48	2018	Özel
P24	Education	5 weeks	5-6-7. grade students	26	2019	Konyaoğlu
P25	Education	8 weeks	6. grade students	112	2019	Akman Selçuk
P26	Education	5 weeks	6. grade students	122	2019	Güleryüz

It is seen that the hardware and software used in the researches are different robot training sets such as Lego Midstorms NXT Education Robotics Kit, Lego WeDo, Arduino Kit and Robotis Dream etc. (Table 2). It has been determined that the researchers used the robotic training kits produced by the lego company until 2017, so the most used hardware and software of the lego company was used (f=17), detailed information is given in Appendix B.

Table 2. Hardware and software used in research

Hardware	Software	Frequency
Lego Midstorms NXT Education Robotics Kit	Midstorms NXT	13
Lego WeDo	Midstorms	4
Arduino Kit	Scratch mBlock	4
Robotis Dream	RoboPlus Task	2
Make Block	Scratch mBlock	2
Edison Educational Robot	EdWare	1
Preschool Robot Education Kit	…	1

It has been determined that the majority of the researches use many different data collection tools for the purpose of their studies (Appendix C). The majority of the researches choose the experimental method (Table 3).

Table 3. Method of the educational robotics studies

Method	Frequency
Experimental	9
Semi-Experimental	5
Mixed	7
Case Study	5

According to the codes obtained from the content analysis conducted by examining the researches reached within the scope of this study, the skill acquisition and definition categories of robotic applications were created. “Scientific process”, “problem solving”, “social”, “creative thinking”, “reflective thinking”, “cooperation”, “metacognitive awareness”, “discovery” and “critical thinking skills” were emphasized by the researchers in the acquired skills category (Table 4).

Table 4. Skill Acquisition Category of Robotic Applications

	scientific process	problem solving	social	creative thinking	reflective thinking	cooperation	metacognitive awareness	discovery	critical thinking
P1									
P2	x								
P3	x								
P4									
P5									
P6	x								
P7									
P8	x								
P9									
P10		x	x					x	
P11	x								
P12									
P13		x		x					
P14			x			x			
P15	x								
P16									
P17				x					
P18		x					x		
P19		x			x				
P20		x			x				
P21									
P22			x						
P23				x		x			x
P24		x							
P25	x								
P26			x						

Researchers define the robotic applications “develop motivation”, “positive attitude towards the lesson”, “entertaining”, “visual functional and efficient education tool”, “increase interest in the lesson”, “academic achievement enhancer”, “usable in lesson”, “develop self-confidence”, “effective in programming learning”, “provide students personal development”, “effective in meaningful learning”, “active participant”, “develop self-perception”, “student-teacher communication and interaction provider”(Table 5).

Table 5. Definition Category of Robotic Applications

	develop motivation	entertaining	positive attitude towards the lesson	visual functional and efficient education tool	increase interest in the lesson	academic achievement enhancer	usable in lesson	develop self-confidence	effective in programming learning	provide students personal development	effective in meaningful learning	active participant	develop self-perception	student-teacher communication and interaction provider
P1				x										
P2													x	
P3	x		x				x							
P4			x				x							
P5		x			x									
P6			x			x	x							
P7	x			x	x	x		x			x	x		
P8			x											
P9	x		x			x								
P10				x										
P11			x		x									
P12							x							
P13	x	x	x						x					
P14	x					x								x
P15	x	x		x	x									
P16		x			x					x				
P17	x	x		x										
P18														
P19														
P20														
P21				x					x					
P22		x												
P23	x				x	x		x		x				
P24		x												
P25	x					x		x						
P26		x						x		x				

DISCUSSION AND CONCLUSION

Technology-based learning, robotic-assisted learning, the use of robots in education and training, robot programming are being studied on the use of robots in the field of education. In this study, the academic research on the use of robots in education in Turkey was examined. According to the findings, the robotics on work in the field of education in Turkey was launched in 2005, the kind of education and the long-term is carried out, most of the target audience is primary level generally has been determined that use many different data collection tools for that and purpose use of experimental methods.

Within the scope of this study, the researches reached have been examined and the skill acquisition and definition categories of robotic applications have been created according to the codes obtained from the content analysis. Contribution of robotic researches to students and education in both categories is expressed in codes. Besides some similarities such as target group, usage of

hardware and software etc. with this paper; Yolcu and Demirer (2017) determined that problem solving and cooperation skills are particularly examined in the studies, but in this paper scientific process and problem solving skills are highlighted. This article is thought to be a guide for researchers who will study educational in robotics.

REFERENCES

Akman Selçuk, N. (2019). *The investigation of educational robotics activities on middle school students' course motivation, robotic attitudes and success.* İstanbul Üniversitesi, Fen Bilimleri Enstitüsü, Enformatik Anabilim Dalı, Enformatik Bilim Dalı, Doktora Tezi.

Avcı, B., (2017). *Lego Mindstorms Robotik Projelerinin Öğretmen Adaylarının Teknolojik Pedagojik Alan Bilgisi, Problem Çözme Becerileri ve Bilimsel YaratıcılıklarıÜzerine Etkisi*. Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü, İlköğretim Anabilim Dalı, Fen Bilgisi Öğretmenliği Bilim Dalı, Yüksek Lisans Tezi.

Beatbots. (2007). KEEPON. Retrieved from http://beatbots.net/, Erişim Tarihi: 09.07.2019.

Çankaya, S., Durak, G. &Yünkül, E. (2017). Robotlarla Programlama Eğitimi: Öğrencilerin deneyimlerinin ve Görüşlerinin İncelenmesi. *Turkish Online Journal of Qualitative Inquiry,* 8(4), 428-445.

Çavaş, B., & Çavaş, H. P. (2005). Technology Based Learning: Robotics Club, *AB-2005*, Gaziantep Üniversitesi, 2-4 February 2005, Gaziantep.

Çayır, E. (2010). *LEGO-LOGO ile Desteklenmiş Öğrenme Ortamlarının Bilimsel Süreç Becerileri ve Benlik Algısı Üzerine Etkisinin Belirlenmesi*, Sakarya Üniversitesi, Sosyal Bilimler Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Bilim Dalı Yüksek Lisans Tezi.

Çukurbaşı, B., (2017). *Ters Yüz Edilmiş Sınıf Modeli ve Lego-Logo Uygulamaları ile Desteklenmiş Probleme Dayalı Öğretim Uygulamalarının Lise Öğrencilerinin Başarı ve Motivasyonlarına Etkisi*. Sakarya Üniversitesi, Eğitim Bilimleri Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı, DoktoraTezi.

Demirer, V., & Erbaş, C. (2016). Trends in studies on virtual learning environments in Turkey between 1996 2014 Years: A content analysis. *Turkish Online Journal of Distance Education, 17*(4).

Dizman, A. (2018). *Kodlama, Robotik, 3D Tasarım ve Oyun Tasarımı Eğitiminin 11-14 Yaş Grubu Öğrencilerinin Problem Çözme Becerileri ve Üstbilişsel Farkındalık Düzeyine Etkisi,* Bahçeşehir Üniversitesi, Eğitim Bilimleri Enstitüsü, Eğitim Teknolojisi Bilim Dalı, Yüksek Lisans Tezi.

Dönmez, İ. (2017). STEM Eğitimi Çerçevesinde Robotik Turnuvalara Yönelik Öğrenci ve Takım Koçlarının Görüşleri (Bilim Kahramanları Buluşuyor Örneği). *Eğitim, Bilim ve Teknoloji Araştırmaları Dergisi,* 2(1), 25-42.

Ekiz, D. (2003). Eğitimde Araştırma Yöntem ve Metotlarına Giriş: Nitel, Nicel ve Eleştirel Kuram Metodolojileri. Anı Yayıncılık, Ankara.

Eraslan, M., Şenol, A. K., Kılınç, A., & Büyük, U., 2013. Üstün Zekalı Öğrencilerin Fen Öğretiminde Robot Teknolojisinin Kullanımına Yönelik Görüşleri. *Researcher: Social Science Studies* ,Sayı Cilt 1 Sayı 1, s. 24-39.

Fels, D.I., & Weiss, P. (2001). Video-mediated communication in the classroom to support sick children: A case study. *International Journal of Industrial Ergonomics,* 28, 251–263.

Güleryüz, B.G. (2019). *Effect of secondary school students' the self-efficacy on incourse robotics coding activities of block based programming and their opinions on robotics coding.* Bursa Uludağ Üniversitesi, Eğitim Bilimleri Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı, Yüksek Lisans Tezi.

Han, J., Jo, M., Park, S., & Kim, S. (2005). The Educational Use of Home Robots for Children. *In Proceedings of the 14th IEEE International Workshop on Robot and Human Interactive Communication (RO-MAN 2005*), 378–383. Piscataway, NJ: IEEE.

Han, J. (2010). *Robot-aided Learning AND R-Learning Services*. INTECH Open Access Publisher.

Hyun, E., Kim, S., Jang, S., & Park, S. (2008). Comparative study of effects of language education program using intelligence robot and multimedia on linguistic ability of young children. *Proceedings of the 14th IEEE International Workshop on Robot and Human Interactive Communication (RO-MAN 2008).* Piscataway, NJ: IEEE.

Kanda, T., Hirano, T., Eaton, D., & Ishiguro, H. (2004). ınteractive robots as social partners and peer tutors for children: a field trial. *Human-Computer Interaction,* 19(1–2), 61–84.

Kasalak, İ., (2017). *Robotik Kodlama Etkinliklerinin Ortaokul Öğrencilerinin Kodlamaya İlişkin Öz-Yeterlik Algılarına Etkisi ve Etkinliklere İlişkin Öğrenci Yaşantıları*, Hacettepe Üniversitesi, Eğitim Bilimleri Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı, Yüksek Lisans Tezi.

Kılınç, A. (2014). *Robotik Teknolojisinin 7. Sınıf Işık Ünitesi Öğretiminde Kullanımı,* Erciyes Üniversitesi, Eğitim Bilimleri Enstitüsü, İlköğretim Anabilim Dalı, Fen Bilgisi Eğitimi Bilim Dalı, Yüksek Lisans Tezi.

Kılınç, A., Koç Şenol, A., Eraslan, M. & Büyük U. (2013). Robotik destekli fen öğretimi: Bilsem örneği. *International Symposium on Changes and New Trends in Education,* November 22-24, Konya, Turkey.

Kırkan, B. (2018). *Üstün Yetenekli Ortaokul Öğrencilerinin Proje Tabanlı Temel Robotik Eğitim Süreçlerindeki Yaratıcı, Yansıtıcı Düşünme ve Problem Çözme Becerilerine İlişkin Davranışlarının ve Görüşlerinin İncelenmesi,* Başkent Üniversitesi, Eğitim Bilimleri Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı ,Bilgisayar ve Öğretim, Yüksek Lisans Tezi.

Kim, Jong-Won, Kim, Jung-Kwan (2011). The Effectiveness of Robot Pronunciation Training for Second Language Acquisition by Children: Segmental and Suprasegmental Feature Analysis Approaches. *International Journal of Robots, Education and Art.* 1,1 http://www.aicit.org/ijrea/ppl/1_IJREA1005001IP.pdf E.T. 31.01.2012.

Koç Şenol, A. (2012). *Robotik Destekli Fen ve Teknoloji Laboratuvar Uygulamaları: ROBOLAB*. Erciyes Üniversitesi, Eğitim Bilimleri Enstitüsü.yüksek lisans tezi.

Koç Şenol, A. & Büyük, U. (2015). Robotik Destekli Fen ve Teknoloji Laboratuvar Uygulamaları: ROBOLAB. *Turkish Studies: International Periodical For The Languages, Literature and History of Turkish or Turkic*, 10(3), s. 213-236.

Konyaoğlu, C. (2019). *The effects of robotic coding education on the problem solving skills of secondary school students and the views of the students about robotic coding activities.* Bolu Abant İzzet Baysal Üniversitesi, Eğitim Bilimleri Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim, Yüksek Lisans Tezi.

Kuş, M., (2016). *Ortaokul Öğrencilerinin Kuvvet ve Hareket Ünitesinin Öğretiminde Robotik Modüllerin Etkisi,* İstanbul Üniversitesi, Eğitim Bilimleri Enstitüsü, Aile Eğitimi ve Danışmanlığı Anabilim Dalı, Fen Bilgisi Eğitimi Bilim Dalı, Yüksek Lisans Tezi.

Küçük, S., & Şişman, B. (2017). Birebir Robotik Öğretiminde Öğreticilerin Deneyimleri. *İlköğretim Online*, 16(1).

Movellan, J.R., Eckhardt, M., Virnes, M., & Rodriguez A. (2009). Sociable robot improves toddler vocabulary skills. *In Proceedings of the 4th ACM/IEEE Human Robot Interaction*, 307–308. New York, NY: ACM.

Movellan, J.R., Tanaka,F., Fortenberry, B., & Aisaka, K. (2005). The RUBI/QRIO Project: Origins, principles, and first steps. *In Proceedings. The 4nd International Conference on Development and Learning, 80 86.*

NEC. (2012). Communication Robot PaPeRo. Retrieved from http://www.nec.co.jp/products/robot/en/index.html.

Okkesim, B. (2014). *Fen ve Teknoloji Eğitiminde Robotik Uygulamaları,* Erciyes Üniversitesi, Eğitim Bilimleri Enstitüsü, İlköğretim Anabilim Dalı, Fen Bilgisi Eğitimi Bilim Dalı, Yüksek Lisans Tezi.

Özdoğru E. (2013). *Fiziksel Olaylar Öğrenme Alanı için için Lego Program Tabanlı Fen ve Teknoloji Eğitiminin Öğrencilerin Akademik Başarılarına, Bilimsel Süreç Becerilerine ve Fen ve Teknoloji Dersine Yönelik Tutumlarına Etkisi,* Dokuz Eylül Üniversitesi, Eğitim Bilimleri Enstitüsü İlköğretim Anabilim Dalı Fen Bilgisi Öğretmenliği Programı, Yüksek Lisans Tezi.

Özel,M. (2018). *Robotik Biliminin Ortaokul 8. Sınıf Fen Bilimleri Dersine Entegrasyonu,* İstanbul Üniversitesi Cerrahpaşa, Lisansüstü Eğitim Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı, Yüksek Lisans Tezi.

Pakman, N. (2018). *8-10 Yaş Grubu Öğrencilerine Uygulanan Temel Düzey Kodlama, Robotik, 3d Tasarım ve Oyun Tasarımı Eğitiminin Problem Çözme ve Yansıtıcı Düşünme Becerilerine Etkisi*, Bahçeşehir Üniversitesi, Eğitim Bilimleri Enstitüsü, Eğitim Teknolojisi Bilim Dalı, Yüksek Lisans Tezi.

Park, S., Han, J., Kang, B., & Shin, K. (2011). Teaching assistant robot, ROBOSEM, in English class and practical issues for its diffusion. *Proceedings of IEEE A Workshop on Advanced Robotics and its Social Impacts*, http://www.arso2011.org/papers.

Shuster, R. (2012, April 1). English teaching robot comes with a cost. *Korea IT Times.* Retrieved from http://www.koreaittimes.com/story/8216/english-teaching-robot-comes-cost

Silik, Y. (2016). *Eğitsel Robotik Uygulamalarının Fen Bilgisi Öğretmen Adaylarının Problem Çözme Becerilerine Etkisi*, Karadeniz Teknik Üniversitesi, Eğitim Bilimleri Enstitüsü, İlköğretim Anabilim Dalı, Fen Bilgisi Eğitimi Bilim Dalı, Yüksek Lisans Tezi.

Şimşek, E. (2018). *Programlama Öğretiminde Robotik ve Scratch Uygulamalarının Öğrencilerin Bilgi İşlemsel Düşünme Becerileri ve Akademik Başarılarına Etkisi,* Ondokuz Mayıs Üniversitesi, Eğitim Bilimleri Enstitüsü, Bilgisayar ve Öğretim Teknolojileri Eğitimi Anabilim Dalı, Yüksek Lisans Tezi.

Türe, G. (2018*). Okul Öncesi Dönem Çocukları İçin Robotik Eğitim Programı Geliştirilmesi ve Sosyal Becerilere Etkisinin İncelenmesi,* İstanbul Üniversitesi-Cerrahpaşa, Lisansüstü Eğitim Enstitüsü, Temel Eğitim Anabilim Dalı, Okul Öncesi Eğitimi Bilim Dalı, Yüksek Lisans Tezi.

VGo. (2011). VGo communications. Retrieved from http://www.vgocom.com/

Yolcu, V., & Demirer, V. (2017). Eğitimde robotik kullanımı ile ilgili yapılan çalışmalara sistematik bir bakış. *SDU International Journal of Educational Studies, 4*(2), 127-139.

Yonhapnews. (2009, December 22). *English tutoring Telepresence robot: Roti*. Retrieved from http://www.youtube.com/watch?v=-_wa_SZaqQU

You, Z., Shen, C., Chang, C., Liu, B., & Chen G. (2006). A robot as a teaching assistant in an English class. *In Proceedings of the 6th IEEE International Conference on Advanced Learning Technologies,* 87–91. New York, NY: IEEE.7

Zengin, M. (2016). İlkokul, Ortaokul ve Lise Öğrencilerin Disiplinlerarası Eğitim ve Öğretiminde Robotik Sistemlerinin Kullanımına Yönelik Görüşleri. *Üstün Yetenekliler Eğitimi ve Araştırmaları Dergisi (UYAD),* 4(2).

Appendix A. Publication Classification Form for Robot Programming

Publication Number	Referance
Publication Source	Publication Title
Publication Year	Type (article, thesis, etc)
Sample Size	Sample Level
Method (Quantitative, Qualitative, Mixed, Literature review)	Data Collection Tool
Educational Event Type	Educational Event Type
Hardware	Software
Variables	Conclusion

Appendix B. Hardware and software used in research

No	Hardware	Software
P1	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P2	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P3	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P4	Lego WeDo	Midstorms
P5	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P6	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P7	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P8	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P9	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P10	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P11	Lego WeDo	Midstorms
P12	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P13	Lego WeDo	Midstorms
P14	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P15	Lego Midstorms NXT Education Robotics Kit	Midstorms NXT
P16	Arduino Kit	Scratch mBlock
P17	Robotis Dream	RoboPlus Task
P18	Lego Midstorms NXT Robot Eğitim Seti	Midstorms NXT
P19	Make Block	Scratch mBlock
P20	Lego WeDo	Midstorms
P21	Arduino Kit	Scratch mBlock
P22	Preschool Robot Education Kit	…
P23	Robotis Dream	RoboPlus Task
P24	Make Block, Edison Educational Robot	Scratch mBlock, Edware
P25	Arduino Kit	Scratch mBlock
P26	Arduino Kit	Scratch mBlock

Appendix C. Method and data collection tool of the educational robotics studies

No	Method	Data collection tool
P1	Case Study	Project
P2	Exprimental	Scientific Process Skill Test, Piers-Harris Self Concept Scale
P3	Exprimental	Robotic Preliminary Survey, Robotic Satisfaction Test, Scientific Process Skills Test, Science and Technology Lesson Motivation Scale
P4	Semi Exprimental	Robotics Student Pre-Survey, Robotic Satisfaction Survey
P5	Case Study	Robotic Student Preliminary Interview Form, Robotic Satisfaction Form, Student Activity Diary
P6	Exprimental	Academic Achievement Test, Attitude Scale towards Science and Technology Course, Scientific Process Skills Test, Semi-Structured Interview
P7	Semi Exprimental	Light Unit Achievement Test, Science and Technology Lesson Motivation Scale and Semi-Structured Interviews
P8	Exprimental	Robotic Pretest, Scientific Process Skills Test, Science Course Attitude Scale
P9	Mixed	Force and Motion Achievement Test, Science and Technology Attitude Scale, Motivation Scale for Learning Science
P10	Mixed	Field Notes, Semi-Structured Interviews, Video Recording, Problem Solving Skills Scale
P11	Exprimental	Participant Student Preliminary Survey, Application Process of Robotic Workshops Participant Student Satisfaction Survey, Participant Student Acquisition Survey of Robotic Tent Workshops
P12	Mixed	Scientific Creativity Test, Technological Pedagogical Content Knowledge Test, Problem Solving Inventory, Structured Interview Form
P13	Mixed	Creative Problem Solving Test, Applied Performance Evaluation Questions, Semi-Structured Interview
P14	Mixed	Observation, Focus Group Interview, Achievement Test and Motivation Scale
P15	Case Study	Interview form
P16	Exprimental	Efficiency Perception Scale, Self-efficacy Perception Scale for Block Based Programming
P17	Case Study	Interview form
P18	Semi Exprimental	Problem Solving Inventory, Metacognitive Awareness Inventory
P19	Case Study	Product Development Rubric, Interview, Daily, Problem Solving Inventory in Children, Reflective Thinking Level Determination Scale
P20	Semi Exprimental	Problem Solving Inventory for Primary School Children, Reflective Thinking Skill Scale for Problem Solving
P21	Semi Exprimental	Pre-test, Achievement test, Interview
P22	Exprimental	Preschool Social Skill Evaluation Scale
P23	Exprimental	Science Success Test, Technology Attitude Scale, STEM Attitude Scale, Student Diaries
P24	Exprimental	Robotic Preliminary Questionnaire, Robotic Satisfaction Test, Problem Solving Inventory in Children, Efficacy Perception Scale
P25	Mixed	Course interest scale, robotic attitude scale, achievement test, practice exam, semi-structured interview form, teacher daily records
P26	Mixed	Self-efficacy perception scale for block-based programming, Interview form