Appendix A
Summaries of Studies Related to K–6 Preservice Teacher Training for Computing, Coding, and CT

Authors, Year	Participants	Context	Duration, format	Focus	Learning Activities	Assessment/Data	Learning Outcomes	Attitude Outcomes
CS as Content								
Cetin, 2016	56 preservice, K–12 teachers	Programming languages course	30-hour, 6-week unit	Programming	Experimental group used Scratch to create games and animations; control group used C to solve programming problems	Achievement test; practice test; Computer Programming Attitude Scale (Cetin & Ozden, 2015); interviews	Students using Scratch performed significantly higher on parallel achievement and practice posttests than participants who used C	No significant difference between the two groups in attitude toward computer programming
Cetin & Andrews-Larson, 2016	58 preservice, K–12 teachers	Programming languages course	10-hour unit	Computer programming, sorting algorithms	Used Flash to construct visualizations, or animations, of sorting algorithms	Achievement test; Computer Programming Attitude Scale (Cetin & Ozden, 2015)	The experimental group scored significantly higher in achievement than the control group	No significant difference between the two groups in attitude toward computer programming
Jeon & Kim, 2017	110 preservice teachers	CT-based programming course vs. ICT skill-based course	15-week, 45-hour course	Computer programming, CT	Instruction; problem-based learning; constructing a responsive website	Pre/post computer learning attitude assessments (Lee, 2010)		Students in CT course had significantly higher gains in self-efficacy and attitude toward CS education
Ng, 2017	10 preservice, early childhood teachers	Early childhood education program, Hong Kong	Three workshops	Coding, Bee-bots	Lecture, practice, modeling, lesson planning, microteaching, discussion, collaboration	Learning package designed by students	Increased coding skills and ability to design coding activities aligned to learning theory	

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Sadik et al., 2017	12 preservice teachers (11 K–6; 1 secondary)	Advanced computer education course	Several-week course unit	CT, coding, robotics	Collaboratively developed and taught a two-hour instructional activity	Student proposals, blog posts, video discussions, papers, and reflections	Increased understanding of CT, but misconceptions persisted	
Integrated CS								
Chang & Peterson, 2018	59 preservice, K–6 & special ed. teachers	Educational technology course	2-hour activity	CT, robotics, coding	Lecture, exploration, & sharing or reflection	Written reflection	Increased understanding of CT; teaching applications	Improved attitudes, perceptions of relevance
Jaipal-Jamani, 2018	36 preservice, K–8 teachers	Science methods course	Two 3-hour classes	Robotics, programming	Constructing and programming gears and LEGO WeDo robots	Pre/post assessments of interest, self-efficacy, and science content knowledge	Increased understanding of gears	Increased interest in robots & self-efficacy for teaching robotics
Jaipal-Jamani & Angeli, 2017	21 preservice, K–6 teachers	Science methods course	Two 3-hour classes	CT, robotics, programming	Modeling; constructing and programming LEGO WeDo robots	Pre/post assessments of interest, self-efficacy, and science content knowledge; programming activities	Increased knowledge of CT and gears	Increased interest in robots & self-efficacy for teaching robotics
Kaya, Yesilyurt, Newley, & Deniz, 2018	35 preservice teachers	Undergrad science teaching methods course	Six 90-minute classes	CT, robotics, coding	Instruction; robotics challenge with Lego Mindstorms; programmed in code.org; solved Zoombinis video game puzzles	Modified Science Teaching Efficacy Belief Instrument (STEBI-B; Enochs & Riggs, 1990; STEM Learning and Research Center, n.d.)		Self-efficacy increased significantly; outcome expectancy did not
Kim et al., 2015	16 preservice, K–6 teachers	STEM instruction course	3-week course unit	Robot assembly, programming	Assembled and programmed robots using My Robot Time and RoboRobo kits; developed lesson plans	Pre/posttests, surveys, interviews	No significant differences in pre and posttest scores for science, technology, engineering, or	Improved motivation, enjoyment, interest in science, and

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							mathematical knowledge	interest in engineering
Ma, Lai, Williams, Prejean, & Ford, 2008	32 preservice, K–6 teachers	Technology integration course	12-hour training	Robotics	Instruction, programming activities; practice facilitating activities with children; collaborative reflection	Reflective journal entries and interviews	Increased knowledge and skills to facilitate learning	
Yadav, Mayfield, Zhou, Hambrusch, & Korb, 2014	357 preservice, K–12 teachers	Introductory psychology course	Two 50-minute classes	CT	Instruction, problem-solving, examples	CT quiz, Computing Attitude Questionnaire	Greater understanding of CT and CT pedagogy than control group.	No statistically significant difference in comfort or interest.