APPENDIX

Table A. Papers on Wearables for Learning Classified by Manner of Use

Manner of Wearable Use: *Capture data to inform learning*							
#	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
1	Buchem et al.	Designing for User Engagement in Wearable-technology Enhanced Learning for Healthy Ageing	2015	Design	Smart wristband	Health	Students	None
2	Buchem et al.	Gamification Designs in Wearable Enhanced Learning for Healthy Ageing	2015	Design	Smart wristband	Health	Students	Anywhere
3	Chu et al.	Toward Wearable App Design for Children's In-the-World Science Inquiry	2017	Study	Smartwatch	Science	Students	Lab, Anywhere
4	Ciolacu et al.	Education 4.0 - Jump to Innovation with IoT in Higher Education	2019	Study	Smartwatch	Health	Students	Anywhere
5	Ciolacu et al.	Enabling IoT in Education 4.0 with BioSensors from Wearables and Artificial Intelligence	2019	Study	Smartwatch	Math, General	Students	School
6	Coffman and Klinger	Google Glass: Using Wearable Technologies to Enhance Teaching and Learning	2015	Study	Smart glasses	Educational psychology, Organizational behavior	Students + teachers	School
7	Ezenwoke et al.	Wearable Technology: Opportunities and Challenges for Teaching and Learning in Higher Education in Developing Countries	2016	Study	Smart glasses	Accounting	Teachers	School
8	Garcia et al.	Wearables for Learning: Examining the Smartwatch as a Tool for Situated Science Reflection	2018	Study	Smartwatch	Science	Students	Anywhere, School
9	Giannakos et al.	Monitoring Children's Learning Through Wearable Eye-Tracking: The Case of a Making- Based Coding Activity	2019	Study	Smart glasses	Programming; Electronics	Students	Workshop
10	Giannakos et al.	Fitbit for learning: Towards capturing the learning experience using wearable sensing	2020	Study	Smart wristband	Software engineering	Students	School
11	Grunerbl et al.	Monitoring and enhancing nurse emergency training with wearable devices	2015	Design	Smartwatch	Health	Students	None
12	Ishimaru et al.	Towards an intelligent textbook: eye gaze-based attention extraction on materials for learning and instruction in physics	2016	Study	Smart glasses	Physics	Students	School
13	Lu et al.	Harnessing Commodity Wearable Devices to Capture Learner Engagement	2019	System	Smart wristband	General	Students + teachers	School
14	Di Mitri et al.	Learning Pulse: Using Wearable Biosensors and Learning Analytics to Investigate and Predict Learning Success in Self-regulated Learning	2016	Study	Sensors	Learning	Students	None
15	Park et al.	Design of a wearable sensor badge for smart kindergarten	2002	System	Badge	General	Students	None
16	Pijeira-Diaz et al.	Investigating collaborative learning success with physiological coupling indices based on electrodermal activity	2016	Study	Smart wristband	Science	Students	Lab set up as classroom

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
17	Pijeira-Diaz et al.	Sympathetic arousal commonalities and arousal contagion during collaborative learning: How attuned are triad members?	2019	Study	Smart wristband	Physics	Students	School
18	Prieto et al.	Teaching Analytics: Towards Automatic Extraction of Orchestration Graphs Using Wearable Sensors	2016	Study	Sensors, Smart glasses	Math	Teachers	Lab
19	Russell et al.	First "Glass" Education: Telementored Cardiac Ultrasonography Using Google Glass- A Pilot Study	2014	Study	Smart glasses	Medicine	Students	Lab
20	Scholl et al.	Wearable digitization of life science experiments	2014	Design	Smart glasses	Science	Students	None
21	Spann and Schaeffer	Expanding the scope of learning analytics data: preliminary findings on attention and self-regulation using wearable technology	2017	Study	Smart wristband	Cybersecurity	Students	Learning center
22	Steele and Steele	Applying affective computing techniques to the field of special education	2014	Theory	General	Writing	Students	None
23	Sung et al.	MIT.EDU: M-learning Applications for Classroom Settings	2004	System	Custom device	Finance, Business, Digital Anthropology	Students + teachers	School
24	Sung et al.	Mobile-IT Education (MIT. EDU):m-learning applications for classroom settings	2005	System	Custom device	Finance, Business, Digital Anthropology	Students + teachers	School
25	Teeters	Use of a Wearable Camera System in Conversation: Toward a Companion Tool for SocialEmotional Learning in Autism	2007	Thesis	Custom device	N/A	Students	N/A

Manner of Wearable Use: *Guide embodied behaviors*

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
26	Hallam et al.	Ballet hero: building a garment for memetic embodiment in dance learning	2014	Design	Clothing	Dancing	Students + teachers	Dance hall
27	Huang et al.	PianoTouch: A Wearable Haptic Piano Instruction System for Passive Learning of Piano Skills	2008	Study	Gloves	Music	Students	None
28	Johnson et al.	MusicJacket: the efficacy of realtime vibrotactile feedback for learning to play the violin	2010	Study	Smart wristband	Music	Students	Lab
29	Kutafina et al.	Wearable sensors in medical education: supporting hand hygiene training with a forearm EMG	2015	System	Clothing	Medicine	Students	None
30	Luzhnica et al.	Passive haptic learning for vibrotactile skin reading	2018	Study	Gloves	Skin reading	Students	Lab
31	Matsushita and Iwase	Detecting strumming action while playing guitar	2013	System	Custom device; Clothing	Music	Students	Lab
32	Myllykoski et al.	Prototyping hand-based wearable music education technology	2015	System	Gloves	Music	Students + teachers	None
33	Pescara et al.	Reevaluating passive haptic learning of morse code	2019	Study	Custom device; Clothing	Morse code; Skin reading	Students	Lab
34	Ponce et al.	Emerging technology in surgical education: combining real-time	2014	Theory	Smart glasses	Medicine	Students	Surgical room

		augmented reality and wearable computing devices					
35	Seim et al.	Passive haptic learning of Braille typing	2014	Study	Gloves	Typing	Students	Lab
36	Seim et al.	Towards haptic learning on a smartwatch	2018	Study	Smartwatch	Morse code	Students	Lab
37	Spelmezan	An investigation into the use of tactile instructions in snowboarding	2012	Study	Custom device; Clothing	Snowboarding	Students	Indoor ski resort

Manner of Wearable Use: *Guide the structure of learning*

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
38	Arroyo et al.	Wearable learning: Multiplayer embodied games for math	2017	Study	Smartwatch	Math	Students	School
39	Bower and Sturman	What are the educational affordances of wearable technologies?	2015	Study	Smart glasses	General	Teachers	None
40	Cheng and Tsai	A case study of immersive virtual field trips in an elementary classroom: Students' learning experience and teacher-student interaction behaviors	2019	Study	Smart glasses	Social studies	Students	School
41	Dieck et al.	Enhancing art gallery visitors' learning experience using wearable augmented reality: generic learning outcomes perspective	2018	Study	Smart glasses	Art	Students	Art gallery
42	Engen et al.	Wearable Technologies in the K-12 Classroom- Cross-disciplinary Possibilities and Privacy Pitfalls	2018	Study	Smart wristband	Physical education; Social studies; Math	Students	School
43	Hatami	A study on students´ attitude toward employing smart glasses as a medium for e-learning	2016	Thesis	Smart glasses	Language	Students	Campus; Home; Library
44	Kawai et al.	Tsunami Evacuation Drill System Using Smart Glasses	2015	Design	Smart glasses	Disaster education	Students	School
45	Kazemitabaar et al.	MakerWear: A Tangible Approach to Interactive Wearable Creation for Children	2017	Study	Clothing	STEM	Students	Museum; Afterschool program
46	Kommera et al.	Smart Augmented Reality Glasses in Cybersecurity and Forensic Education	2016	Theory	Smart glasses	Cybersecurity ; Forensics	Students	None
47	Leue et al. [46]	Google Glass Augmented Reality: Generic Learning Outcomes for Art Galleries	2015	Study	Smart glasses	Art	Students	Art gallery
48	Lindberg et al.	Enhancing Physical Education with Exergames and Wearable Technology	2016	Study	Smart wristband	Physical education	Students	School
49	Liu	Tangram Race Mathematical Game: Combining Wearable Technology and Traditional Games for Enhancing Mathematics Learning	2014	Thesis	Custom device	Math	Students	School
50	Liu and Chiang	Smart glasses based intelligent trainer for factory new recruits	2018	System	Smart glasses	Industrial tasks	Students	Lab set up as factory
51	Lukowicz et al.	Glass-physics: using google glass to support high school physics experiments	2015	Study	Smart glasses	Physics	Students	Lab
52	Moshtaghi et al.	Using Google Glass to Solve Communication and Surgical Education Challenges in the Operating Room	2015	Study	Smart glasses	Medicine; Surgery	Students + teachers	Surgical room

53	Scholl et al.	Wearables in the wet lab: a laboratory system for capturing and guiding experiments	2015	System	Smart glasses; Smartwatch	Science	Students	School
54	Shadiev et al.	Study of the use of wearable devices for healthy and enjoyable English as a foreign language learning in authentic contexts	2018	Study	Smartwatch	Language	Students	School
55	Spitzer et al.	Distance Learning and Assistance Using Smart Glasses	2018	Study	Smart glasses	Industrial tasks	Teachers	Lab
56	Spitzer et al.	Project Based Learning: from the Idea to a Finished LEGO Technic Artifact, Assembled by Using Smart Glasses	2017	Study	Smart glasses	Industrial tasks	Students	Lab
57	Spitzer et al.	Use cases and architecture of an information system to integrate smart glasses in educational environments	2016	Theory	Smart glasses	Knitting	Students + teachers	Lab
58	Vallurupalli et al.	Wearable technology to improve education and patient outcomes in a cardiology fellowship program- a feasibility study	2013	Study	Smart glasses	Medicine	Students	None
59	Vishkaie	Can wearable technology improve children's creativity?	2018	Study	General	General	Students	Lab
60	Weppner et al.	Physics Education with Google Glass gPhysics Experiment App	2014	System	Smart glasses	Physics	Students	None

Manner of Wearable Use: *Guide students' classroom behaviors*

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
61	Watanabe and Yano	Using wearable sensor badges to improve scholastic performance	2013	Study	Badge	General	Students + teachers	School
62	Zheng and Motti	Assisting students with intellectual and developmental disabilities in inclusive education with smartwatches	2018	Design	Smartwatch	General	Students	School
63	Zheng and Motti	Wearable Life: A Wrist-Worn Application to Assist Students in Special Education	2017	Design	Smartwatch	General	Students + teachers	Learning center

Manner of Wearable Use: *Help teachers to learn about the class or the students*

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
64	de la Guia et al.	Introducing IoT and wearable technologies into task-based language learning for young children	2016	Study	Smartwatch	Language	Students	Lab set up as classroom
65	Holstein et al.	The Classroom as a Dashboard: Co-designing Wearable Cognitive Augmentation for K-12 Teachers	2018	Study	Smart glasses	General	Teachers	Lab
66	Kumar et al.	Use of smart glasses in education - a study	2018	Theory	Smart glasses	General	Teachers	None
67	Llorente and Morant	Wearable Computers and Big Data: Interaction Paradigms for Knowledge Building in Higher Education	2014	Theory	Smartwatch; Smart glasses	General	Teachers	None
68	Martinez-Maldonado et al.	Teacher Tracking with Integrity: What Indoor Positioning Can Reveal About Instructional Proxemics	2020	Study	Badge; Custom device	Design; Healthcare; Science	Teachers	School
69	Martinez-Maldonado et al.	Physical Learning Analytics: A Multimodal Perspective	2018	Design	Sensors	Dancing; Healthcare	Teachers	School

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
70	Pirkl et al.	Any Problems? a wearable sensorbased platform for representational learning-analytics	2016	Study	Smartwatch	Physics	Students	Lab
71	Quintana et al.	Keeping Watch: Exploring Wearable Technology Designs for K-12 Teachers	2016	Study	Smartwatch	Astronomy	Teachers	School
72	Ueda and Ikeda	Stimulation Methods for Students' Studies using Wearable Technology	2016	System	Smartwatch; Smart wristband	General	Students + teachers	School

Manner of Wearable Use: *Make knowledge visible*

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
73	Knight et al.	Wearable technology: using Google Glass as a teaching tool	2015	Study	Smart glasses	Medicine	Teachers	Surgical room
74	Kuhn et al.	gPhysics- Using Smart Glasses for Head-Centered, Context-Aware Learning in Physics Experiments	2016	Study	Smart glasses	Physics	Students	None
75	Labus et al.	Wearable Computing in EEducation	2015	Design	General	General	Students	None
76	Lee et al.	Appropriating Quantified Self Technologies to Support Elementary Statistical Teaching and Learning	2016	Study	Smart wristband	Statistics	Students	School
77	Meyer et al.	Investigating the effect of pretraining when learning through immersive virtual reality and video: A media and methods experiment	2019	Study	Smart glasses	Science	Students	School
78	Norooz	BodyVis: Body Learning Through Wearable Sensing and Visualization	2014	Thesis	Clothing	Anatomy	Students	Afterschool program
79	Norooz et al.	BodyVis: A New Approach to Body Learning Through Wearable Sensing and Visualization	2015	Study	Clothing	Science	Students + teachers	Lab; Afterschool program
80	Norooz et al.	"That's Your Heart!": Live Physiological Sensing and Visualization Tools for Life-Relevant and Collaborative STEM Learning	2016	Study	Clothing	Health	Students	Afterschool program
81	Pataranutaporn et al.	Wearable Wisdom: An Intelligent Audio-Based System for Mediating Wisdom and Advice	2020	System	Smart glasses	General	Students	None
82	Peppler and Glosson	Learning About Circuitry with Etextiles in After-School Settings	2013	Study	Custom device	Electronics	Students	None
83	Pham and Hwang	Card-based design combined with spaced repetition: A new interface for displaying learning elements and improving active recall	2016	Study	Smartwatch	Language	Students	None
84	Ryokai et al.	EnergyBugs: energy harvesting wearables for children	2014	Study	Custom device	Energy	Students	Summer camp; School
85	Thees et al.	Effects of augmented reality on learning and cognitive load in university physics laboratory courses	2020	Study	Smart glasses	Physics	Students	School

Manner of Wearable Use: *As a platform to learn STEM*

	Authors	Paper Title	Year	Paper Type	Wearable Types	Subject Areas	Population Type	Settings
86	Brady et al.	All Roads Lead to Computing: Making, Participatory Simulations, and Social Computing as Pathways to Computer Science	2017	Study	Custom device	Programming	Students	School

87	Buechley et al.	Towards a curriculum for electronic textiles in the high school classroom	2007	Theory	Clothing	Programming; Electronics	Students	School; Workshop
88	Burg	A STEM Incubator to Engage Students in Hands-on, Relevant Learning: A Report from the Field	2016	Study	Custom device	Programming; Electronics	Students	School
89	Eisenberg et al.	Invisibility Considered Harmful: Revisiting Traditional Principles of Ubiquitous Computing in the Context of Education	2006	Theory	Clothing	Programming	Students	Lab
90	Esakia et al.	Augmenting Undergraduate Computer Science Education With Programmable Smartwatches	2015	Study	Smartwatch	Programming	Students	School
91	Gregg et al.	A Modern Wearable Devices Course for Computer Science Undergraduates	2017	Theory	Custom device	Electronics	Students	School
92	Jones et al.	Wearable bits: Scaffolding creativity with a prototyping toolkit for wearable e-Textiles	2020	Design	Clothing	Design	Students	Workshop
93	Kuznetsov et al.	Breaking boundaries: strategies for mentoring through textile and computing workshops	2011	Study	Clothing	Programming	Students	Workshop
94	Lau et al.	Learning programming through fashion and design: a pilot summer course in wearable computing for middle school students	2009	Study	Clothing	Programming	Students	Workshop
95	Merkouris et al.	Introducing Computer Programming to Children through Robotic and Wearable Devices	2015	Study	Smartwatch	Programming	Students	Lab
96	Merkouris et al.	Teaching Programming in Secondary Education Through Embodied Computing Platforms: Robotics and Wearables	2017	Study	Custom device	Programming	Students	School
97	Ngai et al.	An education-friendly construction platform for wearable computing	2009	Design	Clothing	Programming; Electronics	Students	Summer camp
98	Ngai et al.	i*CATch: a scalable plug-n-play wearable computing framework for novices and children	2010	Design	Clothing	Programming; Electronics	Students	Workshop
99	Ngai et al.	Deploying a Wearable Computing Platform for Computing Education	2009	Study	Clothing	Programming; General engineering	Students	Summer camp
100	Reichel et al.	Smart Fashion and Learning about Digital Culture	2006	Study	Clothing	Programming	Students	None
101	Reichel et al.	Eduwear: Designing Smart Textiles for Playful Learning	2008	Design	Clothing	Programming	Students	None
102	Reimann	Shaping Interactive Media with the Sewing Machine: Smart Textile as an Artistic Context to Engage Girls in Technology and Engineering Education	2011	Design	Gloves	Programming	Students	None
103	Reimann and Maday	Smart Textile objects and conductible ink as a context for arts based teaching and learning of computational thinking at primary school	2016	System	Clothing	Programming	Students	None