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# Innovations in Educational Robotics

# **Advancing AI for Sustainable Development**

Ali Sorayyaei Azar, Tariq Elyas, Muthmainnah Muthmainnah, and Samantha Curle



## Preface

The rapid advancements in artificial intelligence (AI) and robotics have ushered in a new era of innovation across various domains, including education. With the increasing integration of AI-driven technologies, particularly in educational robotics, we are witnessing transformative shifts in how learning is delivered, experienced, and sustained. In this volume, *Innovations in Educational Robotics: Advancing AI for Sustainable Development*, we present a collection of pioneering research and insights that explore the profound impact of AI and robotics on education and their role in fostering sustainable development.

This edited volume brings together distinguished scholars and researchers from diverse academic institutions and backgrounds to examine the evolving landscape of educational robotics. The contributions in this book cover a wide spectrum of topics, ranging from the implementation of AI in the metaverse for education, constructivist approaches in robotics learning, and the synergy between AI and robotics in modern education to AI-driven classroom interactions, language learning tools, and professional development for educators. These discussions are set against the backdrop of sustainable development, emphasizing the need for equitable, inclusive, and accessible educational opportunities worldwide.

In *Chapter 1*, Marwa Adel delves into the intersection of AI and the metaverse, highlighting the opportunities and challenges posed by this convergence in education. This is followed by *Chapter 2*, where Niranchana Viswanathan and Ramesh SR examine the feasibility of integrating metaverse technologies in educational institutions in emerging economies, addressing key concerns related to infrastructure, accessibility, and financial investment.

Moving forward, *Chapter 3* by Andi Asrifan and colleagues explores how constructivist learning theories intersect with robotics education to create engaging, student-centered learning environments. *Chapter 4* by Froilan Mobo, Ali Sorayyaei Azar, and Ana Liza Garcia discusses the dynamic synergy between AI and robotics in modern education, emphasizing personalized learning and interactive teaching methodologies. In *Chapter 5*, Manjari Sharma and Sharad Gupta investigate the transformative role of AI in educational robotics, providing case studies and strategic recommendations. This is complemented by *Chapter 6*, where Nihta Liando and Devilito Tatipang examine curriculum development strategies in robotics education, emphasizing inclusivity and interdisciplinary approaches.

*Chapter 7*, authored by Austin Musundire, shifts the focus to Africa, discussing the challenges and opportunities of integrating AI and robotics into STEM education on the continent. In a similar vein, *Chapter 8* by Prashasti Pritiprada and colleagues presents the concept of "RoboRevolution," exploring how robotics can contribute to sustainable futures and environmental consciousness.

The subsequent chapters further delve into the transformative impact of AI on education. *Chapter 9* by Nur Aeni and colleagues explores AI-driven classroom conversations, demonstrating how AI enhances student engagement in speaking classes. *Chapter 10* by Zuraina Ali and her co-authors examines the effects of AI-powered language tools on student attitudes and test anxiety, shedding light on the psychological aspects of AI in education.

In *Chapter 11*, Abd Ghofur discusses how AI-integrated robotics can support sustainability education by equipping students with problem-solving skills to tackle real-world challenges. Finally, *Chapter 12* by Sezen Arslan and Samantha Curle addresses the intersection of AI, English Medium Instruction (EMI), and Sustainable Development Goals (SDGs), highlighting implications for teacher professional development.

As editors, we are honored to present this comprehensive volume, which we hope will serve as a valuable resource for educators, researchers, policymakers, and practitioners. The insights shared in this book underscore the significance of AI and robotics in shaping the future of education while emphasizing the ethical considerations, challenges, and opportunities that accompany these advancements.

We extend our deepest gratitude to all the contributing authors for their dedication and scholarly contributions, as well as to our respective institutions for their support. We also thank the readers for their interest in this crucial and evolving field. It is our hope that this book will inspire further research and practical innovations that will drive sustainable educational development in the years to come.

#### Ali Sorayyaei Azar

University of Malaya, Malaysia

#### **Tariq Elyas**

King Abdulaziz University, Saudi Arabia

#### **Muthmainnah Muthmainnah**

Universitas Al Asyariah Mandar Sulawesi Barat, Indonesia

## Samantha Curle

University of Bath, United Kingdom

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## About the Contributors

Ali Sorayyaei Azar is an Assistant Professor at the Department of Language and Literacy Education within the Faculty of Education, University of Malaya (UM), Malaysia. He also got his Ph.D. in Applied Linguistics from the Faculty of Languages and Linguistics, University of Malaya, Malaysia. In a career spanning 27 years, he has worked as an EFL/ESL senior lecturer, researcher, and curriculum developer in Iran, Turkey, Qatar, and Malaysia. He has published and presented research papers on his topic of interest namely Academic Discourse Analysis, Genre Analysis, Corpus Linguistics, TESL, Educational Technology, and English Language Teaching Strategies in several prestigious journals including GEMA Online@ Journal of Language Studies (UKM, Malaysia), Asian ESP Journal, Asian EFL Journal, Studies in English Language and Education, World Journal of English Language, and Education and Information Technologies (Springer). He is the head of MAAL- SIG (Research Methods in Applied Linguistics). He is also the Editor of three books, including 'Reconceptions of Policies, Strategies, and Challenges in Education 5.0.', 'Innovations in Educational Robotics: Advancing AI for Sustainable Development', and 'Smart Education and Sustainable Learning Environments in Smart Cities'. IGI Global- Publisher, USA has published the three edited volumes. Besides, Dr. Azar has been appointed as a member of the Editorial Board for several journals, including the Asian Journal of University Education (AJUE) indexed in Scopus- Q2, established by Universiti Teknologi MARA, Shah Alam, Malaysia; the International Journal of Modern Languages and Applied Linguistics (IJMAL), established by Akademi Pengajian Bahasa (APB), Universiti Teknologi MARA, Shah Alam, Malaysia; Education Quarterly Reviews- indexed in ERIC, established by the Asian Institute of Research, Indonesia; and the journal of Pragmatics and Discourse Research- indexed in Sinta 3, established by Perkumpulan Pengelola Jurnal Bahasa Sastra dan Pengajarannya (PPJBSIP), Indonesia. Scopus Author: 55561989000

**Tariq Elyas** is a full-tenured professor of Applied Linguistics at King Abdulaziz University, KAU (Saudi Arabia). He holds an MA in English Literature (USA) a PhD in Applied Linguistics (Australia), an LLM in International Law and Human Rights (UK), and a Post-Doctorate in Applied Linguistics from Newcastle University via the British Commonwealth Council (UK). Prof. Elyas's areas of interest include global English, teacher identity, policy reform, the media, and female studies in the Middle East. Prof. Elyas has worked in numerous educational posts in Australia, the UK, the USA, and Saudi Arabia. Prof. Elyas has been assigned as an Associate Editor for the Wiley Encyclopedia of World Englishes-MENA Region, as well as the Tourism Section Editor for Routledge Resources Online-English in the Real World. Prof. Elyas has been the top-cited researcher in Saudi Arabia in the fields of Applied Linguistics and Education since 2014.

**Muthmainnah**, an esteemed Assistant Professor at Universitas Al Asyariah Mandar in West Sulawesi, Indonesia, boasts a remarkable career marked by multifaceted roles and significant contributions to academia. With a wealth of experience as a lecturer, global speaker, and international leader, she has held various prestigious positions within her university, including Chairman of the Indonesian Language Department, Public Relations Officer, and Deputy Director of the Language and Character Development Institute. She serves as an external examiner for PhD students at top-rated institutions globally, emphasizing her commitment to international collaboration and academic excellence. With an extensive online presence and a commitment to academic advancement, Muthmainnah is poised to make significant contributions to the global academic community.

**Samantha Curle** is a Reader in Education (Applied Linguistics) at the University of Bath, Director of all MRes programmes, and Institutional Academic Lead for the South-West Doctoral Training Partnership. She is also Adjunct Professor at Khazar University and an Associate Member of the EMI Oxford Research Group. Her research examines factors influencing academic achievement in EMI, including English proficiency and psychological constructs. She has published six edited books (one forthcoming) and her work appears in top journals such as Language Teaching, Applied Linguistics Review, and Studies in Higher Education. Her research spans Africa, Asia, Europe, and South America, with funding from the European Commission, British Academy Newton Fund, British Council, and national research councils in Hong Kong and Turkey. Dr Curle is a Fellow of the Higher Education Academy and the Royal Society of Arts.

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**Nur Aeni** a lecturer of English Education Department at Universitas Negeri Makassar. She attended some International Conference as the Presenter. Namely: Brown Bag Seminar at Northern Illinois University, DeKalb, USA, Closing Ceremony of PKPI in 2016 at Northern Illinois University, DeKalb, IL, USA. International Conference on language education, TEFLIN International Conference in 2018, International Conference on Education. Science, Art and Technology in 2018: AsiaTEFL 2020 International Conference (Kintex.Goyang South Korea, virtually). She is a member of TEFLIN and ASIA TEFL. She is the Assessor for BKD, she pursed from the Indonesian Minister of Education and Culture.

Sezen Arslan is an associate professor of English Language Teaching at Bandırma Onyedi Eylul University in Turkey. She received her MA degree from Çanakkale Onsekiz Mart University and her Ph.D. degree in English Language Teaching from Hacettepe University. She has taught undergraduate courses in language testing/assessment and material development. She published in various refereed journals and presented papers in national and international conferences. She has also served on the editorial boards of international journals. Her main research interests are foreign language teacher training, professional development of language teachers, assessment, and intercultural awareness in language classrooms.

Andi Asrifan, S.Pd, M.Pd, a distinguished figure in the realm of education, particularly in English Language Education, has made significant contributions through his extensive research, teaching, and leadership roles. As the Head of the Institute for Cooperation and International Affairs at Universitas Muhammadiyah Sidenreng Rappang and now a lecturer in Universitas Negeri Makassar (UNM), Dr. Asrifan's academic journey is marked by a rich tapestry of achievements, including a Doctor of Education in English Language Education. His work spans various facets of education, language, and technology, reflecting the diverse topics covered in his publications and research endeavors. These include, but are not limited to, the impact of the COVID-19 pandemic on educational practices, methodologies in English as a Foreign Language (EFL) classrooms, and the integration of technology in teaching and learning processes. Dr. Asrifan's commitment to advancing educational standards and practices is further evidenced by his active participation in international conferences, webinars, and workshops across countries like India, the Philippines, and Pakistan. These events, organized by various institutions and associations, underscore his role as a global educator and thought leader. His dedication to professional development is also highlighted through his involvement in numerous courses and certifications in personal branding, public speaking, and literacy teaching. Moreover, Dr. Asrifan's leadership extends beyond academia into organizational and educational development, where he has served in various capacities, including as an external examiner for Ph.D. dissertations and a reviewer for scientific journals. His accolades, memberships in professional organizations, and roles as an ambassador for international associations speak volumes of his influence and commitment to fostering educational excellence and sustainable development goals globally.

**Sharad Gupta** is a seasoned professional with over 20 years of experience in industry and academia, both nationally and internationally. He holds an MBA, dual MCom, and an MA in Education, along with a diploma from Harvard Business School. Gupta has worked in media, software development, finance, and education industries, demonstrating strong business acumen and a keen interest in innovation and entrepreneurial activities.

Faidhul Inayah is a lecturer at faculty of art and design, Universitas Negeri Makassar

La Sunra, M. Hum is a lecturer of English Education Department at Universitas Negeri Makassar. He earned doctoral degree on English Education Program from the Pascasarjana Universitas Negeri Makassar, Indonesia. He has publised many papers in international and national journal. Namely: Teachers' Reflective Practice and Challenges in an Indonesian EFL Secondary School Classroom (International Journal of Language Education 4 (2), 2020

Nihta Vera Frelly Liando, born in Manado on August 3rd 1970, is currently a Professor at the English Education Department Faculty of Languages and Arts Universitas Negeri Manado. She received her first degree from Universitas Negeri Manado (previously known as IKIP Negeri Manado) in 1993. Her Master of Arts by Research was obtained from University of Adelaide Australia followed by a Ph.D from University of Queensland in Australia in 2007. She has presented in various conferences in Indonesia and beyond. She has also published articles in various national accredited and reputable international journals. Her areas of interests are in teaching English as a foreign language (TEFL), sociolinguistics and educational psychology. Prof. Liando is actively involved in English teacher association in Indonesia, called TEFLIN (Teachers of English as a Foreign Language in Indonesia) and currently serving as the Coordinator for Sulawesi and Maluku Region. She has also been serving as the Head of Department of English Education since 2020. She is also a fulltime member of AsiaTEFL, an organization of teachers of English in Asia. It is her belief that there are always rooms for quality improvement and that process never betrays results. Age quo agis.

**Froilan Mobo** He is a Doctor of Public Administration graduate from the Urdaneta City University Class of 2016 and a graduate of the 2nd Doctorate Degree (Ph.D.) in Development Education program at the Central Luzon State University, Nueva Ecija, Philippines, Class of 2022. On March 11, 2024, Dr. Mobo was accredited and reclassified by the Commission on Higher Education (CHED) to the position of Professor II in the Philippine Merchant Marine Academy (PMMA), and this allowed him to work with different international research institutions, such as the Director and Research Consultant of the IKSAD Research Institute, Turkey. At present, he is in the process of finishing his 3rd master's degree, leading to social studies education at Bicol University. Recently, Dr. Mobo passed Batch 3—Certified Research Professional—and ranked in the top 5 in the National Examination.

Auliyanti Sahril Nurfadhilah is an English lecturer at Universitas Negeri Makassar. She holds a Doctoral's Degree in English Education and a Master's degree in TESOL Studies from the University of Leeds. Her research interests include English Language Teaching, digital learning approaches in ELT, teaching English to young learners, and assessment in ELT. She is actively engaged in research and teaching, focusing on innovative pedagogical strategies to enhance language learning. She can be reached at auliyantisn@unm.ac.id.

Nursyam is a highly accomplished Indonesian professional with a rich background in English education. She holds a doctoral degree, underscoring her extensive academic achievements and dedication to her field. Over the years, Nursyam has accumulated significant experience in teaching and working within the maritime education sector, where she has made notable contributions. Her commitment to advancing knowledge is evident through her scholarly pursuits, which have led to the publication of several scientific papers. These publications reflect her research dedication and desire to contribute to the academic community. Currently, Nursyam serves as the Head of the Sea Transportation Management Study Program at Politeknik Pelayaran Barombong. In this leadership role, she continues to influence and shape the future of maritime education, demonstrating her commitment to fostering educational excellence. Her position allows her to guide and mentor the next generation of maritime professionals, ensuring they are well-prepared to meet the industry's challenges. Nursyam's career is marked by her dedication to her students and field, making her a respected figure in maritime education. Her contributions have advanced her career and have had a lasting impact on the institutions and individuals she has worked with. Through her leadership and academic work, Nursyam exemplifies the qualities of a dedicated educator and a committed professional, continually striving to enhance the field of maritime education.

Nurwahida is a lecturer of Art and Design Faculty, Universitas Negeri Makassar

Hadi Pajarianto is a distinguished academic in the field of Islamic Education, with a profound focus on research related to religious moderation, tolerance, and local wisdom. Since 2011, he has successfully secured numerous research grants from prestigious institutions such as the Ministry of Education and Culture, LPDP, and Johns Hopkins Bloomberg School of Public Health. His dedication to education is further exemplified by his participation in the Training of Trainers (TOT) for National Values Enhancement organized by LEMHANNAS in 2022. Prof. Pajarianto's professional journey includes roles as a high school teacher and a lecturer since 2004. He has held significant positions such as Head of Quality Assurance Unit and Head of Research and Community Service at AKBIDM Palopo, as well as Vice Director for Student Affairs and Finance. Currently, he serves as Vice Rector II for Resources, Assets, and Business at Universitas Muhammadiyah Palopo. His academic credentials include a Bachelor's degree in Islamic Education from STAIN Palopo (2004), a Master's, and a Doctorate in Education from UIN Alauddin Makassar (2013, 2016). Prof. Pajarianto is renowned for his skills in teaching, research, community service, and higher education management. His motto, "Give One Hundred Percent or Not at All," reflects his commitment to excellence in all his endeavors.

Hj. Like Raskova Octaberliana, M.Ed, stands out as a distinguished educational figure, particularly in English language teaching. With an impressive educational background that includes a Master's degree from Monash University, Australia, and a Doctorate from the State University of Malang, Indonesia, she brings a wealth of knowledge and expertise to her profession. Prof. Like Raskova Octaberliana is recognized for her academic achievements and dynamic involvement in various capacities, such as a speaker, trainer, and keynote speaker at national and international platforms. Her contributions extend to numerous conferences, workshops, and seminars, where she shares her insights on English language teaching, education, and motivation training. Her professional journey is marked by a strong foundation in English linguistics, literature, and language teaching methodologies, complemented by her publications in several esteemed journals. Prof. Like Raskova Octaberliana's dedication to the field is further evidenced by her active participation in international conferences and research projects and her commitment to teaching English. As a member of various professional organizations, she has enriched her experience by working across different educational institutions, fostering an environment of learning and growth. Moreover, Prof. Like Raskova Octaberliana's expertise is not limited to language teaching; she is also highly skilled in public speaking, human resource development, and personality character building. Her motivational training sessions are particularly noteworthy, as she has earned numerous awards and scholarships. This recognition is a testament to her impactful contributions to education and her ability to inspire and cultivate the minds of learners and educators alike. Prof. Dr. Like Raskova Octaberliana, M.Ed, embodies the essence of a dedicated educator and mentor whose work continues to influence English language teaching and beyond.

**Ramesh S** Associate Professor. Having 18+ years of experience and handling more than 1500 + students as a director at Hallmark Business school. Having experience in Administration role and academic well know academician in Tamil Nādu.

**Manjari Sharma** is an Associate Professor at CHRIST (Deemed to be University), Pune Lavasa Campus, with over 15 years of teaching experience. She holds a Ph.D., an MBA in Finance & Marketing, an M.Com., and a B.Com. Dr. Sharma specializes in Managerial Economics, Financial Management, Securities Analysis, Portfolio Management, and Operations Management. Known for her innovative teaching methods, she has authored several publications and co-authored multiple books.

Rochma Sudiati is a highly skilled finance, accounting, and tax professional with 14 years of experience across various industries. She holds a Magister of Accounting from the University of Mercu Buana, Jakarta, and a Bachelor of Accounting from the University of Islamic "45" Bekasi. Complementing her formal education, she has pursued non-formal qualifications, including a Tax Brevet (A & B) from LPAM Trisakti and certification as a Hijrah Mind Practitioner. Her professional journey spans multiple roles with increasing responsibilities. Currently, Rochma is a lecturer at Universitas Negeri Jakarta and an accounting consultant at PT. Asia Agro Internasional. She also served as the Finance, Accounting & Tax General Manager at PT. Multi Bangun Abadi from 2020 to 2024, where she managed day-to-day operations, cash flow, tax compliance, and financial reporting. She was instrumental in planning and monitoring budgets, analyzing financial statements, and controlling accounts payable and receivable. In this role, she led a team, supervised junior staff, and implemented accounting systems to improve operational efficiency. With 14 years of expertise, Rochma has held other notable positions, such as Head of Accounting at PT Remala Abadi, where she handled financial reporting, tax preparation, and system upgrades. At Sofyan Corporation and Madina Islamic School, she was responsible for overseeing the finance and accounting departments, preparing budgets, managing school assets, and ensuring compliance with tax regulations. In addition to her accounting and finance expertise,

Rochma is proficient in various accounting software like Accurate, Zahir, and MYOB, and tax software such as eSPT. Her bilingual fluency in Bahasa Indonesia and English, combined with her leadership and auditing skills, make her a valuable asset in managing complex financial operations.

Nurfaida Tasni is a lecturer at STKIP YPUP Makassar, where she has been teaching since 2012. She holds a Bachelor's and Master's degree in Mathematics Education from Universitas Negeri Makassar, and earned her Doctoral degree from Universitas Negeri Malang in 2019, specializing in Mathematics Education. Throughout her career, Dr. Tasni has been deeply involved in academic research, focusing on mathematical problem-solving and cognitive development in students. She has contributed extensively to scholarly publications, serving as both an author and a reviewer for various national and international journals. Among her roles, she is a member of the editorial board for Jurnal Lebesgue at Universitas Bina Bangsa, and a reviewer for multiple academic journals, including PEPATUDZU and Jurnal Pendidikan Indonesia. Dr. Tasni is also an active participant in professional organizations, such as the Indonesian Mathematics Educators Society (I-MES) and the Indonesian Association of Educators and Educational Developers (APPI). Her research primarily explores mathematical thinking, problem-solving skills, and the application of cooperative learning models in mathematics education. She is highly committed to enhancing the quality of education in Indonesia, with a strong focus on integrating technology and innovative teaching methods in her field.

**Devilito Prasetyo Tatipang** born in Maelang on December 30th 1999, is currently a Research Consultant, Journal Reviewer, Researcher, Journal Manager and Editor, Mendeley Mentor, Research-Assistant and full-time Lecturer-Assistant of English Education Department of the Faculty of Languages and Arts, Universitas Negeri Manado. He completed his Bachelor degree at Universitas Negeri Manado in 2021 and Master degree at the same University in 2023, since then he has presented his research in various National and International conferences in Indonesia. He has also published articles in several nationally accredited and reputable international journals. Devilito's areas of interests are in Technology-Injected Language Learning, Issues in English Language Teaching (ELT), Pedagogical Linguistics, Curriculum Development, ELT in Multilingualism Context, Motivational Studies and Pedagogy for English Language Learners (ELL)

Niranchana Viswanathan ASSISTANT PROFESSOR • Assisting with various departmental duties and providing academic support to Professors and other staff. • Recruiting, training, and mentoring new TAs and other junior staff. • Conducting research and publishing papers in academic journals. • Representing the university

at conferences and delivering presentations when necessary. • Teaching and supervising undergraduate and graduate students. • Providing demonstrations and supervising experiments and investigations. • Answering questions in class or via email or telephone. • Providing Professors and Department Heads with feedback on student progress. • Writing proposals to secure funding for research. Attending faculty and departmental meetings and voicing concerns or providing suggestions for improvement. Most sincerely, NiranchanaShri Viswanathan 8105849988