

Program Logic Outline: Implementing Einsteinian Physics into the K-12 Curriculum

Situation

- International desire to teach Einsteinian Physics (EP) throughout schooling from the physics fraternity, co-lead by Prof Blair, UWA
- Previous ARC research grant demonstrated the feasibility of this.
- New EP-reliant technologies are being developed and adopted, and as far as possible we should understand these.
- The National and State STEM Education agendas demand higher level STEM knowledge and skills for the future workforce.
- ARC Linkage Grant awarded to UWA, with support of industry partners, early in 2019, with funding available from late 2019.



Priorities

- Identify and confirm involvement of 12 primary and 12 secondary schools to be involved in the research.
- Develop and sustain a high level of engagement with the research schools' network and build on this network.
- Establish research protocols with schools – what is expected of them and what support will they receive.
- Establish a governance and management structure for the initiative: roles and responsibility of all participants (Cis, Pl's, team etc.)
- Appoint Post-Doctoral fellows and PhD students to the team.
- Phase 1 – initial sequencing – develop initial EP curriculum sequence and draft teaching program for Years 3 to 10, assuming Years 11 and 12 are already covered.
- Develop professional learning model, resources to help teachers 'intellectualise' their practice and implement EP.
- Develop draft assessments to be used to assess student learning and validate learning progressions.
- Confirm longitudinal design with principals and teachers.
- Sustain the international collaboration through the textbook, online communications, sharing platforms, meetings and conferences.
- Ongoing evaluation with annual reporting to key stakeholders



Inputs	What we invest in <ul style="list-style-type: none"> • Identify and invest in the relationship with research schools – the teachers and principals. • Development of the initial EP curriculum sequences and draft teaching programs. • Development of innovative, on-line/face-to-face professional learning model and resources and identify ways of recognising and providing credit for their participation including link to AITSL Teacher Standards etc. • Development of quality assessments to assess student learning and validate learning progressions. • Induction of new team members and teachers as they come on board. 	Assumptions What we assume <ul style="list-style-type: none"> • Based on the previous research, the EP concepts to be taught are within the grasp of students. • Schools and teachers will stay engaged in the research initiative. • Ethics approval will be provided. • Teachers will be sufficiently prepared and able to participate in mixed-mode professional learning, with a blend of on-line, face-to-face and coaching. • It will be possible to change the curriculum. • Resources restricted to the current research proposal, will need to seek and secure additional national funding from government and private sources.
	Outputs	Development activities: We will have: <ul style="list-style-type: none"> • A scope and sequence to teach EP concepts for Year 3 to 12. • Models for teaching EP concepts to school-aged children and young adults. • Validate high quality assessment resources. • Secondary and primary research schools to implement and assess the EP curriculum. • A detailed plan to implement the research design outlined in the ARC Linkage submission. • A comprehensive, de-identified database of students and teachers involved, paying particular attention to tracking student progress from year to year and confidential record keeping. • Ongoing evaluation by systematically collecting feedback on all aspects of the program.
		Participation: Who needs to be involved In the short-term (to the end of 2021): Einstein- First Team; research partners including school sectors and teachers from the research schools and their school principals. In the medium to longer-term (from 2022 and beyond): The above plus curriculum agencies and curriculum developers, including education resource developers; university and education faculties across Australia for pre-service teacher training; government and industry.
Outcomes and Impact	Short Term (end-2020) results are: <ul style="list-style-type: none"> • Refine communication channels, including re-vamping of the website. • Human ethics clearance approval from UWA, Education Department and Catholic Education WA. • 12 primary and 12 secondary schools engaged to be involved in the research, with 'agreements' signed confirming longitudinal design with principals and teachers. • School Network identified, engaged and prepared to trial lessons in 2020 and conduct the research in 2021. • Post-Doctoral fellows and PhD students appointed to the team and inducted. • Governance, management structure and project management software for the initiative established. • Research protocols with schools part of schools agreement – expectations both ways and support. • Phase 1 – initial sequencing – Draft EP curriculum sequence and teaching program for Years 3 to 10. • Professional learning model and resources available to support teachers implementing EP. • Professional learning ongoing as new teachers inducted into the program. • Draft assessments to be used to assess student learning and validate learning progressions developed. • Develop comprehensive plan to review the program and review early stages. 	External Factors Factors out of our control <ul style="list-style-type: none"> • Impact of COVID-19 on schools and the timeline for the research program. • Operation of each of the research schools, thus the need to ensure strong, close and positive involvement through collaboration. • Long-term adoption of EP into schools across WA and Australia – need support from Curriculum Authorities and school systems. The Commitment of the schools and their teachers to the research. • Mobility of teachers and school leadership.
	Medium Term (up to the end of 2021) results are: <ul style="list-style-type: none"> • Research schools and teachers fully engaged and trained ready to teach curriculum • Network of schools engaged through the entirety of the research, and build on this network. • Professional learning ongoing as new teachers inducted into the program. • Extensive feedback and advice from schools gathered on support • High quality assessment data on ES physics outcomes for all students involved plus school achievement data: NAPLAN Reading, Writing and Numeracy. • Review first year of program and use to inform stakeholders. 	
	Long Term (from 2024 and beyond) results or ultimate impacts are: <ul style="list-style-type: none"> • Research papers published: international and local (Australian aimed at teachers/curriculum change). • PhDs and Post-Doctoral fellow publications. • International, national and state conference presentations, particularly teacher associations. • Comprehensive teaching and learning resources available on website with associate professional learning for access across Australia and internationally. • Submission to government and industry (particularly those heavily reliant on EP technologies) to support Australia-wide implementation subject to inclusion in the next iteration of the Australian curriculum. • Review program annually and use to inform stakeholders. 	