

**RESEARCH GRANTS COUNCIL
THEME-BASED RESEARCH SCHEME (TRS)**

Completion Report on Funded Project

Project start date: 1/11/2016
Project completion date: 31/3/2022

1. Project Title: Learning and Assessment for Digital Citizenship

2. Names and Academic Affiliations of Project Team Members[#]

Project team member	Name / Post	Unit / Department / Institution	Average number of hours per week spent on this project in the current reporting period
Project Coordinator (PC)	Nancy LAW/Professor	Faculty of Education, HKU	15
Co-Principal Investigator(s)*	King-Wa FU/ Professor (promoted from Associate Professor on 1 Oct 2021)	Journalism and Media Studies Centre, HKU	8
	Patrick IP/ Clinical Associate Professor	Dept. of Paediatrics and Adolescent Medicine, HKU	5
	Nirmala RAO/ Professor	Faculty of Education, HKU	5
	Jimmy DE LA TORRE/ Professor	Faculty of Education, HKU	8
	Ricky KWOK/ Honorary Professor (left HKU 31 Jan 2021)	Electrical & Electronic Engineering Dept, HKU	6
	Ting-Chuen PONG/ Professor	Dept. of Computer Science & Engineering, HKUST	6

	Hossain Liaquat/ Professor (until Jun 2019)	Faculty of Education, HKU	N.A.
Co-Investigator(s)	Michael CHAU/ Associate Professor	Business School, HKU	2
	Sam K W CHU/ Associate Professor	Faculty of Education, HKU	2
	Xiao HU/ Associate Professor	Faculty of Education, HKU	3
	Edmund LAM/ Professor	Electrical & Electronic Engineering Dept, HKU	5
	Ka Yee Elizabeth LOH/ Assistant Professor	Faculty of Education, HKU	2
	Xiaojuan MA/ Associate Professor (promoted from Assistant Professor on 1 July 2021)	Dept. of Computer Science & Engineering, HKUST	4
	Tom McDONALD/ Associate Professor (promoted from Assistant Professor on 18 Aug 2021)	Department of Sociology, HKU	2
	David POMFRET/ Professor	History Department, HKU	1
	Huamin QU/ Professor	Dept. of Computer Science & Engineering, HKUST	5
	Wan Yee Winnie TSO/ Clinical Assistant Prof.	Dept. of Paediatrics and Adolescent Medicine, HKU	6
	Allan YUEN/ President	Yew Chung College of Early Childhood Education	2
	Vincent TAM/Principal Lecturer	Dept. of Electrical & Electronic Engineering, HKU	2
	Gary WONG/ Assistant Professor	Faculty of Education, HKU	3
	Maggie ZHAO/Director	Teaching and Learning Evaluation and Measurement Unit, HKU	2
	Cheng Yong TAN/ Associate Professor (from September 2020)	Faculty of Education, HKU	2
	Shihui FENG/ Assistant Professor (from September 2020)	Faculty of Education, HKU	2
Collaborators	Terry BOSSOMAIER/ Professor	Faculty of Business, Charles Sturt University	N.A.
	Ola ERSTAD/ Professor	Dept. of Education, University of Oslo	N.A.
	Harvey GOLDSTEIN/ Professor	Centre for Multilevel Modelling, Univ. of Bristol	N.A.
	Patrick GRIFFIN/ Emeritus Professor	Graduate School of Education, Univ. of Melbourne	N.A.
	Vincent LAU/ Director of	HK Advanced Science and	N.A.

	Research	Technology Research Institute	
	Una-May O'REILY/ Principal research scientist	Computer Science and AI Lab Massachusetts Institute of Technology	N.A.
	Barbara WASSON/ Professor	Dept. of Information Sc. & Media Studies, Univ. of Bergen	N.A.

Please highlight the approved changes in the project team composition and quote the date when the RGC granted approval of such changes. For changes in the project team composition, please submit a separate request, together with the justification and the curriculum vitae of the new member(s), to the RGC three months prior to the intended effective date of the change.

3. Project Objectives

Summary of objectives addressed/achieved:

Objectives*	Percentage achieved	Remarks**
1. To develop a conceptual framework for digital citizenship that encompasses the cognitive outcomes for digital literacy, metacognitive and social outcomes for collaborative problem solving and affective outcomes for self-regulation, based on the relevant theoretical, pedagogical and assessment research literature.	100%	There are two publications that have made key contributions to achieving this objective. 1. Building on the relevant theoretical, pedagogical and assessment literature, and recognizing the pervasive impact of technology in the 21st century, particularly on globalization and ubiquitous connectivity through social media, Law et al. (2018) defined digital citizenship as <i>the competence, rights (awareness), and responsibility to engage and participate in a globally networked world for personal and social wellness</i>. This book chapter also discusses the implications of such a conceptualization of digital citizenship (DC) for civic education, what constitutes a digital citizenship curriculum, and the challenges that would be encountered in its implementation. 2. Chen et al. (2021) is an integrative review on the conceptualization and measurement of digital citizenship published in journals across a wide range of disciplines. Out of a total of 114 peer-reviewed journal papers, just over half provided an explicit definition for DC. While the most popular definitions are dominated by two perspectives: digital competence (Ribble et al.'s work) and social participation (Mossberger et al., 2007), only two of the publications reported on measurement of digital civic engagement and both of which are in Politics related journals, even though more than half of the papers reviewed were in the field of education. Another noteworthy observation is that studies that utilized cyber wellness specific instruments were only published in

Objectives*	Percentage achieved	Remarks**
		media/communication journals and not the education specific journals. This paper also highlights the need for DC research to go beyond the relatively static status view of the two classic conceptualizations to recognize the performative conceptualization of DC (Isin & Rupert, 2015, 2020)—that is, the rights of digital citizens are not a given, but have to be enacted through what is said and what is done. This integrative review identified significant conceptual and empirical gaps in DC research, and demonstrates the need for interdisciplinary collaboration for these gaps to be addressed. Law, N. W. Y., Chow, S. L., & Fu, K. W. (2018). Digital citizenship and social media: A curriculum perspective. In J. Voogt, G. Knezek, R. Christensen, & K. W. Lai (Eds.), <i>Second Handbook of Information Technology in Primary and Secondary Education</i> (2nd ed., pp. 53-68). Springer. https://doi.org/10.1007/978-3-319-71054-9 Chen, L. L., Mirpuri, S., Rao, N., & Law, N. (2021). Conceptualization and measurement of digital citizenship across disciplines. <i>Educational Research Review</i>, 33, 100379. https://doi.org/10.1016/j.edurev.2021.100379
2. To develop age-appropriate assessment instruments for digital citizenship (age range: 7 to 22). These instruments will incorporate best practices in assessment design. They will incorporate holistic contexts and realistic connected tasks, and can be used to assess digital citizenship outcomes independent of the subject matter content knowledge of the individual assessed. Change: The age range of the assessment instrument was proposed in the Stage 2 report to change to 7-18 years (i.e. cohorts 1 to 3) and agreed by RGC review panel during their visit in September 2018. It was our oversight we have forgotten to update that in our subsequent reports. However, the external review panel have been fully	100%	The project team has done rigorous research that has pushed the frontiers of digital literacy (DL) assessment forward. Three publications highlight the most important contributions related to this specific objective. 1. Through conducting secondary analysis using unidimensional and multidimensional item response theory on representative data collected from primary and secondary school students in Hong Kong collected by HKU researchers in earlier studies, Reichert et al. (2020) reveals a general dimension of digital literacy performance and four specific, tool-dependent dimensions. These specific DL dimensions are defined by the software applications that students use and capture commonality among students' performance that is due to their familiarity with the assessment tools and contexts. The findings show that assessment instruments using connected tasks to address complex, holistic contexts may not be appropriate for the purpose of assessing DL due to the tools and problem context bias.

Objectives*	Percentage achieved	Remarks**
aware of our change in the age range targeted for the assessment. Assessment was only conducted on cohorts 1 to 3 from Wave 1 through to Wave 2 data collection. (On p. 10 of the Stage 2 report, we wrote: “Before reporting on the specific aspects of our work, it is necessary to point out that we have made a decision to change the research focus for cohort 4. There is a strong feeling from the team that the initial proposal to conduct the empirical part of the study in the same way as for the three younger cohorts, as in our initial proposal, is problematic, not only because of the much greater maturity in terms of age, but also that cohort 4 targets only undergraduate students at HKU and HKUST, who are the higher achievers among their age cohort. We have decided that our research will focus on transitioning from life as a high school student to an undergraduate, as well as to investigate university students’ civic participation online.” The external review panel did not raise questions on this point in the set of questions sent to the research team before their review visit in September 2018. In the review panel’s report after the first review visit also did not raise concern on this change in their feedback on Objective 2.)		2. Based on the above finding, we have developed a set of valid and reliable computer-based performance assessment items that can mimic authentic interfaces and interactions for different applications and contexts for use with primary and secondary students. The age-appropriateness of all items was validated through a cognitive interview and a pilot study in 2018. In 2019 (the first wave of main data collection), DL assessment was administered to 1,989 Hong Kong students from Primary 3 to Secondary 5 (approximate age range 7-15). The assessment data were scaled using a two-parameter logistic model, producing a highly reliable digital literacy score (expected a-posteriori reliability = 0.84). Details of the instrument design, development, and psychometric properties were reported in Jin et al. (2020). In 2021 (the second wave of data collection), some items were replaced due to their psychometric performance in 2019. Cognitive interview and a pilot study proved the age-appropriateness of the new items. One-thousand and seventy-one Hong Kong students from Primary 5 to Secondary 5 (approximate age range 11-18) completed the digital literacy assessment, of which 886 students also participated in 2019. The assessment data were scaled using a two-parameter logistic model, and horizontal equating ensured that the scores were on the same scale and comparable in both years to address some modifications in the instrument. This procedure produced a highly reliable cross-year comparable digital literacy score (expected a-posteriori reliability = 0.91). 3. The second wave of the main data collection was conducted in the first half on 2021, which was in the middle of the COVID-19 pandemic. In Hong Kong, there were extended periods of full or partial school suspension during which teaching and learning often occurred remotely using digital means. To ensure that we could successfully complete the second wave data collection as planned, we innovated on the method of assessment delivery by conducting the performance assessment data collection in a mix of modes—onsite, online supported, and

Objectives*	Percentage achieved	Remarks**
		online self-directed. Analyses show no statistically significant association between student performance and the assessment mode adopted (Pan et al., 2022). Our work contributes to the possibility of using remote assessment for DL and possibly in other high-stakes testing. Moving forward, the project team has received an internal grant to validate the use of the digital literacy assessment instrument for university students (aged 18-22). Reichert, F., Zhang, D. J., Law, N. W., Wong, G. K., & de la Torre, J. (2020). Exploring the structure of digital literacy competence assessed using authentic software applications. <i>Educational Technology Research and Development</i>, 68(6), 2991-3013. Jin, K.-Y., Reichert, F., Cagasan, L. P., de la Torre, J., & Law, N. (2020). Measuring digital literacy across three age cohorts: Exploring test dimensionality and performance differences. <i>Computers & Education</i> 157, 103968. https://doi.org/10.1016/j.compedu.2020.103968 Pan, Q., Reichert, F., de la Torre, J., & Law, N. (2022). Measuring digital literacy during the COVID-19 pandemic: Experiences with remote assessment in Hong Kong. <i>Educational Measurement: Issues and Practice</i>, 41(1), 46-50.
3. To identify and further develop a set of contextual indicators for digital technology use, family and school environments for formal and informal learning interactions, and different types of activities (which may or may not be mediated through digital technology) likely to influence the development of a learner's digital competence. We have actually developed two more instruments under this objective beyond what we initially included in the original proposal (the school leaders' survey and parent survey). As such, we would consider that we have accomplished 20% more than our proposed target for this objective.	100%	The project team developed a comprehensive online self-report survey based on the conceptual framework of Livingstone et al., (2015) with the following key components: (a) <i>Digital technology use</i> - Students reported their time spent using digital devices per day regarding five main purposes: (1) communicating with family/friends, (2) at school for leisure activities, (3) at school for schoolwork, (4) at home for leisure activities, and (5) at home for schoolwork. They were also asked how much time they spend on certain online activities at home and at school. (b) <i>Family and school environment</i> – Students reported their family's socio-economic background in terms of home resources (e.g., a quiet place to study) and academic capital (e.g., parents' level of education). They also reported their participation in activities at school. (c) <i>Online safety and risky online behaviour</i> – A set of questions were asked to understand

Objectives*	Percentage achieved	Remarks**
		the extent to which students encountered online security problems (e.g., the computer got a virus), their engagement in risky online communications (e.g., sent personal information to someone that they had never met face to face), and cyberbullying experience. (d) <i>Wellbeing</i> – In order to understand the relations between digital technology use and digital wellbeing, students were asked to report their wellbeing indicators including Internet addiction, game addiction, and mental health status. (e) <i>Others</i> – General health questions such as physical activity and sleep hours were also asked. Details on the context indicators can be found in the two general reports (Reichert et al., 2020; Law et al., 2022). In addition to the originally planned two-wave longitudinal panel study, the research team received funding from two charities in Hong Kong to conduct studies in 2020 and 2022 respectively to find out more about how the COVID-19 pandemic affected children, teachers, schools and families. These two additional studies were titled eCitizen Education 360 (e360 for short). The interest and support shown by the community for e360 was stimulated by this TRS-funded project's finding about the seriousness of the digital divide, particularly the digital competence divide within and across schools, and their implications for students with respect to online learning during the pandemic. We have refined and extended the set of contextual variables through the two e360 studies. In particular, we have developed a <i>parent survey</i> to be administered to parents of children participating in the study. Another important innovation we made was to develop a <i>school leader survey</i> to replace the principal survey used in the Wave 1 survey. School leaders are defined as anyone in the school who has administrative roles (in addition to being a teacher). Hence school leaders included all teachers who play a middle management role as well. The school leader indicators have proved

Objectives*	Percentage achieved	Remarks**
		to have much stronger predictive/explanatory power as school level variables. These indicators are reported in the bulletins published for the general public from the e360 studies (Law et al., 2020-21; Tan et al., 2023) Reichert, F., Lam, P., Loh, E.K.Y. & Law, N. (2020). <i>Hong Kong Students' Digital Citizenship Development. Initial Findings</i>. Hong Kong: The University of Hong Kong. Law, N., Pan Q., Tao, S., Liang, Q., Chen, L.L., Rao, N., Reichert, F. & de la Torre, J. (2022) <i>Hong Kong Students' Digital Citizenship Development 2019-2021: Findings from a Longitudinal Study</i>. Hong Kong: The University of Hong Kong. Law, N., Tan, C. Y., Lan, M., & Pan, Q. (2021a). <i>eCitizen Education 360 Project – Bulletin 1: From outcomes and challenges of online learning to enhanced digital preparedness for the NEW NORMAL</i>. Hong Kong: Faculty of Education, The University of Hong Kong. Law, N., Tan, C. Y., Lan, M., & Pan, Q. (2021b). <i>eCitizen Education 360 Project – Bulletin 2: Online learning preparedness for schools</i>. Hong Kong: Faculty of Education, The University of Hong Kong. Law, N., Tan, C. Y., Lan, M., & Pan, Q. (2021c). <i>eCitizen Education 360 Project – Bulletin 3: Online-learning preparedness for teachers</i>. Hong Kong: Faculty of Education, The University of Hong Kong. Law, N., Tan, C. Y., Lan, M., & Pan, Q. (2021d). <i>eCitizen Education 360 Project – Bulletin 4: Multi-level School Leadership for online learning preparedness</i>. Hong Kong: Faculty of Education, The University of Hong Kong. Law, N., Tan, C. Y., Lan, M., & Pan, Q. (2021e). <i>eCitizen Education 360 Project – Bulletin 5: Parent-Child Communication and Relationship are Key to Students' Wellbeing at Home and in School</i>. Hong Kong: Faculty of Education, The University of Hong Kong. Tan, C.Y., Liang, Q., Pan, Q., Law, N., Lan, M., Tao, S., Chan, C.K.K., Li, W., & Li, Y. et al., (2023). <i>eCitizen Education 360 (2022) Project – Bulletin 1: Cumulative Impact Under New Normal Insights for Positive Actions</i>. Hong Kong: Centre for Information Technology in Education (CITE), Faculty of Education, The University of Hong Kong.
4. To develop serious game designs (role plays/simulations) to foster digital citizenship, focusing on collaborative problem solving (CPS) for selected prototypical, age-appropriate contexts for adolescents and young adults. The game portal will enable the	80%	Building on advances in social neuroscience, social robotics, and collaborative serious games in education, Law & Tsang (2019) critically reviewed the two most popular frameworks used in the assessment of CPS—the frameworks adopted in ATC21S and PISA 2015. The former measures the performance of individuals interacting in human-to-human

Objectives*	Percentage achieved	Remarks**
collection of behavioural game play data, as well as ancillary background data on students, teachers and schools, and capable of performing learning analytics and visualization of the game interactions and other contextual data (serious games design and games portal) Change: Application for change in focused age group of the CPS game to cohorts 1 and 2 students after with the M&S review in September 2020. Approval was obtained on 31 March 2021.		dyads online. The latter measures individual performance when engaging in human to computer agent interactions. Both ignore the performance of the group or team that is collaborating. This book chapter put forward collaborative serious online games as providing viable scenarios for the learning and assessment of CPS at both individual and group levels. Based on the above conceptual exploration, two in-depth case studies of groups of four students engaging in collaborative problem solving were conducted to provide a more empirically grounded framework for the development of online collaborative games to support learning and assessment of CPS. The first study was conducted before the design of the online CPS game. It involved students engaging in collaborative game design over four weekly sessions. Each student was assessed through two methods: (1) using the ATC21S CPS assessment instrument provided by the Assessment Research Centre (ARC) at the University of Melbourne, and (2) using the observational data collected during the game design activities and scored using the ATC21S CPS assessment framework. It was found that even though both assessments used the same assessment framework, the students' performance during different phases of game design were dynamic, changing over time and depending on the task context and their interactions/negotiations with other group members. This puts to doubt the value of the CPS assessment provided by the ARC instrument, which only provides two static scores that are supposed to reflect the latent social and cognitive skills involved in CPS. It was also observed that the outcomes of the game design from the different groups demonstrate different levels of sophistication and thoughtfulness. This calls to doubt whether the assessment of CPS should only be focusing on the CPS process without giving attention to the quality of the CPS outputs. This was reported in Tsang et al. (2019). The second study was conducted after the

Objectives*	Percentage achieved	Remarks**
		prototype online CPS game was completed and available for piloting. As outlined in previous reports and in our meetings with the M&A Panel, we have shifted the focus of serious game designs from adolescents and young adults to cohort 1 and 2 students to maintain theoretical rigour. In designing the online CPS game, the team adhered to an educational focus on digital wellbeing. A mobile multiplayer online game called D-City Fighter was developed to foster digital citizenship, focusing on observing the CPS behaviour of students as they try to work collaboratively to help a cyberbullying victim. Building on the findings from Study 1, Study 2 explores the difference between CPS behaviour and performance exhibited during game play (using the D-City Fighter game) versus game design (the students were asked to design improvements to the D-City game). It was found that the game play setting (i.e., game features such as the engagement, interactivity, immersive features, game mechanics, etc.) stimulated more social interactions, while the game design task stimulated a greater variety of social skills. This was reported in Tsang et al. (2020). Based on findings from the two empirical studies described above, the D-City Fighter game was redeveloped to provide more cognitive and social scaffolding, and the in-game data collection of game play behaviour was integrated into the game design. Algorithms for conducting computational psychometrics analysis of the gameplay data has been developed to assess students' CPS skills. The age-appropriateness of the game was validated through cognitive interviews and a pilot study in 2022. To improve the game design, we invited education experts, teachers, and students to trial the game and asked for their feedback and suggestions about the game usage experience and the game-based assessment task design. The main data collection using the redeveloped game was planned to be completed in 2022.

Objectives*	Percentage achieved	Remarks**
		However, due to the fifth wave of the COVID-19 pandemic and the social distancing restrictions imposed by the government, there is inadequate data for conducting the necessary computational psychometric analysis planned. The main data collection is being conducted in mainland China and Hong Kong. As of March 2023, a total of 364 primary school students have participated in the main data collection. Our target is to collect a sample of 400 students by June 2023. Meanwhile, we are conducting data cleaning, data analysis, and paper writing. This part of the study is expected to be completed by August 2023. Although CPS assessments have attracted attention from the research and assessment communities, few studies designed and developed multiplayer role-playing games to measure students' CPS skills, especially for primary school students. Moreover, psychometric measures of CPS skills performed in previous studies ignored the dynamic nature and skill dependency of CPS. Therefore, we apply evidence-centered design in the design and implement three quests of D-City Fighter game. Based on the multimodal data collected, including in-game logs, conversation data, and questionnaire data, various computational psychometric approaches, such as network analysis and Bayesian networks, will be used to perform dynamic assessments of students' CPS skills while considering the dependency of CPS skills. This study offers researchers both theoretical and methodological insights into game-based assessments of CPS skills. Additionally, our study findings will inform educators about how to deploy personalized CPS interventions to foster primary school students' CPS skills. In summary, we have made significant advances in developing a robust conceptual basis and the development of a viable collaborative online game and analytical methods for the purpose of supporting learning and assessment of CPS skills. We are unable to fully achieve this objective for two key reasons: (1) we underestimated the conceptual and

Objectives*	Percentage achieved	Remarks**
		methodological complexities in achieving this objective and devoted more time than expected in designing and conducting the two in-depth comparative case studies to address these complexities before finalizing the game design, and (2) the disruptions to school routines and academic progress of students caused by the pandemic made it difficult for schools to release precious school time for students to “play games”. The last phase of this work is being conducted by two PhD students, studying at HKU and HKUST respectively. We are confident that we will be able to achieve 100% of this targeted objective, albeit after the completion of this project. Law, N.W.Y., & Tsang, H. W. (2019). Implications of Social Neuroscience for Learning Technology Research and Development. In T. D. Parsons, L. Lin, & D. Cockerham (Eds.), <i>Mind, Brain and Technology</i> (pp. 161-176): Springer. Tsang, H., Park, S. W., Chen, L. L., & Law, N. (2019). Assessing Collaborative Problem Solving: What and How?. In Lund, K., Niccolai, G. P., Lavoué, E., Hmelo-Silver, C., Gweon, G., & Baker, M. (Eds.), <i>A Wide Lens: Combining Embodied, Enactive, Extended, and Embedded Learning in Collaborative Settings, 13th International Conference on Computer Supported Collaborative Learning (CSCL) 2019</i>, Volume 1 (pp. 416-423). Lyon, France: International Society of the Learning Sciences. https://repository.isls.org/handle/1/1598 Tsang, H. W., Liu, Y., & Law, N. (2020). An In-depth Study of Assessment of Collaborative Problem Solving (CPS) Skills of Students in Both Technological and Authentic Learning Settings. In Gresalfi, M. and Horn, I. S. (Eds.), <i>The Interdisciplinarity of the Learning Sciences, 14th International Conference of the Learning Sciences (ICLS) 2020</i>, Volume 3 (pp. 1381-1388). Nashville, Tennessee: International Society of the Learning Sciences. https://repository.isls.org/handle/1/6340
5. To conduct longitudinal studies of the development of digital citizenship that can be continued beyond the project’s lifetime. (longitudinal study design and study portal)	100%	The project team conducted a longitudinal study, collecting data in both the 2018/19 and 2020-21 school years. A total of 18 primary schools and 14 secondary schools participated in the 2018-19 study. Over 2,000 students completed the assessment and/or survey, and approximately 360 teachers and principals of the sampled students responded to short questionnaires. In 2020-21, 12 of the 18 primary schools and 11 of the 14 secondary schools from 2018-19 agreed to participate.

Objectives*	Percentage achieved	Remarks**
		Around 2,000 students completed the assessment and/or survey, of which 886 students also participated in 2018-19. Around 300 teachers and school principals responded to short questionnaires. The longitudinal data revealed important research findings on the development of digital citizenship capacity (i.e., digital literacy and collaborative problem-solving skills) and the relations between contextual indicators and digital citizenship capacity among students between 2019 and 2021. The longitudinal study findings were presented in the general reports and empirical journal articles. Details can be found in Law et al. (2022) and our other research outputs. Law, N., Pan Q., Tao, S., Liang, Q., Chen, L.L., Rao, N., Reichert, F. & de la Torre, J. (2022) <i>Hong Kong Students' Digital Citizenship Development 2019-2021: Findings from a Longitudinal Study</i>. Hong Kong: The University of Hong Kong.

* Please highlight the approved changes in objectives and quote the date when the RGC granted approval of such changes.

** Please provide reasons for significantly slower rate of progress than originally planned.

6. Research Highlights and Outputs

6.1 What are the most exciting research accomplishments of the project?

(Please list five or more of the team's best research accomplishments, such as journal and conference papers, software codes, research infrastructure, etc. For each item, please clearly justify how it has achieved international excellence (e.g. best paper award, invited presentation, citations, product licensed to industry, etc.))

1. ***A valid instrument for assessing digital literacy:*** The project team has developed a valid and reliable computer-based performance assessment for digital citizenship capacity (i.e., digital literacy) that addresses several gaps in previous research, making it possible for the digital literacy performance of students from age 8 to 18 to be measured on the same validated scale. This has been published in *Computers & Education* (ranked 2/270 in Education & Educational Research, impact factor 11.18) and has already been cited 58 times.
 - Jin, K.-Y., Reichert, F., Cagasan, L. P., de la Torre, J., & Law, N. (2020). Measuring digital literacy across three age cohorts: Exploring test dimensionality and performance differences. *Computers & Education* 157, 103968. <https://doi.org/10.1016/j.compedu.2020.103968>
2. ***A conceptualization and a call for digital citizenship research as an interdisciplinary endeavor:*** This integrative review of research articles published in different disciplinary journals and examining how they may be similar or different in terms of conceptualization, research design and instrumentation has provided important insight on how the siloed development of research in the area of digital citizenship has impeded advances in research in the area. This has been published in *Educational Research Review* (ranked 3/270 in Education & Educational Research, impact factor 10.27) and has already been cited 43 times.
 - Chen, L. L., Mirpuri, S., Rao, N., & Law, N. (2021). Conceptualization and measurement of digital citizenship across disciplines. *Educational Research Review*, 33, 100379. <https://doi.org/10.1016/j.edurev.2021.100379>
3. ***A paper on the relationship between social media use and academic distraction.*** This is an important contribution to understanding how undergraduate students as digital citizens are influenced by their use of social media. This has been published in *Computers & Education* (ranked 2/270 in Education & Educational Research, impact factor 11.18) and has already been cited 160 times.
 - Feng, S., Wong, Y. K., Wong, L. Y., & Hossain, L. (2019). The Internet and Facebook usage on academic distraction of college students. *Computers & Education*, 134, 41-49.
4. ***Uncovering digital literacy as a protective factor against game addiction.*** This paper has been published in the medical journal *Lancet Regional Health – Western Pacific* (ranked 3/109 in Health Care Sciences & Services, impact factor 8.56) and has been cited 9 times since publication in 2022.
 - Tso, W.W.Y., Reichert, F., Law, N., Fu, K.W., de la Torre, J., Rao, N., Leung, L.K., Wang, Y-L., Wong, W.H.S., & Ip, P. (2022). Digital competence as a protective factor against gaming addiction in children and adolescents: A cross-sectional study in Hong Kong. *The Lancet Regional Health - Western Pacific*, 20, 100382. <https://doi.org/10.1016/j.lanwpc.2022.100382>
5. ***Revealing the lack of conceptual fidelity of anti-cyberbullying Educational Programs and how that influences the effectiveness of such programs:*** This paper has been published in *Computers in Human Behavior* (ranked 3/91 in Education & Educational

Research, impact factor 8.96) and has already been cited 12 times since its publication in 2022.

- Lan, M., Law, N., & Pan, Q. (2022). Effectiveness of anti-cyberbullying educational programs: A socio-ecologically grounded systematic review and meta-analysis. *Computers in Human Behavior*, 130, 107200. <https://doi.org/10.1016/j.chb.2022.107200>

6. **Identifying factors influencing the quality of the predictions produced by learning analytics programs on learners' performance:** This was published in IEEE Access and cited 54 times.

- Moreno-Marcos, P. M., Pong, T. C., Munoz-Merino, P. J., & Kloos, C. D. (2020). Analysis of the factors influencing learners' performance prediction with learning analytics. *IEEE Access*, 8, 5264-5282. <https://doi.org/10.1109/ACCESS.2019.2963503>

7. **A social-network analysis-based methodology to trace the emergence and development of a field:** This research was stimulated by the research on changes in conceptualization in terms of research in digital citizenship. This paper explores an alternative methodology of conducting systematic analysis of a field. It is the first systematic analysis based on a large number of AI in education related papers to reveal the knowledge structures, clusters, and emerging keywords within the field. Artificial intelligence in education as the target field for two reason: (1) it is likely to have important impact on digital citizenship, and (2) it is an interdisciplinary field that has accumulated a lot of publications in several allied disciplines and hence provides a richer dataset for this methodological exploration. This paper has been published in *Computers in Human Behavior* and has already been cited 12 times since its publication in 2022.

- Feng, S., & Law, N. (2021). Mapping artificial intelligence in education research: A network-based keyword analysis. *International Journal of Artificial Intelligence in Education*, 31, 277-303.

8. **A derived project that won Faculty Knowledge Exchange Award:** The project team has received two external funding to conduct studies on understanding the students' learning and wellbeing under the COVID-19 pandemic. The results of this study were presented at seven press conferences that was widely covered by the local media and in the six bulletins as well as published in high-quality journals, such as *Frontiers in Psychology* (impact factor 4.23) and *npj Science of Learning* (impact factor 5.51). The study has also received *HKU Faculty Knowledge Exchange Award 2021*.

6.2 What was the added value of the TRS funding, rather than standard project grant funding? (For example, could this work have been achieved with other funding scheme, such as the General Research Fund or Collaborative Research Fund? If not, why?)

The General Research Fund is an individual research grant aimed at supplementing the university's own research funding for researchers who have achieved or have the potential to achieve excellence. While it covers basic research to push the frontiers of knowledge, the grant amount per project is typically up to \$2 million, which does not support and may not be enough for a cross-university project that includes five work packages. Although the Collaborative Research Fund supports multi-disciplinary projects with multiple participants to encourage more research groups to engage in creative and high-quality cross-disciplinary and cross-institutional projects, the project usually has a duration of three years and thus not feasible to conduct a more-than-three-year longitudinal study tracking the development of digital

citizenship among primary and secondary school students.

The TRS, however, aims to focus academic research efforts of UGC-funded universities on themes of strategic importance to the long-term development of Hong Kong. It provides a maximum duration of five years and the ceiling of direct project cost per project to be awarded by the RGC is \$75 million. The TRS has several themes, one of which is to “Advancing Emerging Research and Innovations Important to Hong Kong”, which is aligned with the purpose of this project to develop a theoretically robust and empirically grounded conceptual framework and benchmarks for digital citizenship from childhood to early adulthood in Hong Kong. The framework encompasses the cognitive, metacognitive, social, and affective learning outcomes important for personal and social well-being.

Looking back over the past 6.5 years since the launch of the project in November 2016, the project team would not have been able to achieve what we have accomplished: establishing digital citizenship as an interdisciplinary field of research. Even at the quantitative level, to-date, the team has published 19 journal papers in top to good journals, with five at different stages of review after submission, 4 book chapters, 55 peer-reviewed papers in high-ranking international conferences, and 9 invited keynotes/plenary presentations. Team members have also been successfully awarded 9 research grants from external (from HK and non-local funding agencies) as well as internal grants, totally HK\$ 3.8 million. Most importantly, the work that has started has built the foundations for further work in the following areas:

1. The capacity to conduct further research that incorporate the measurement of digital literacy using validated performance assessment tools for a wide age range and in longitudinal studies. Planning is underway to extend the assessment instrument for use by adult populations such as undergraduate students, teachers, and parents.
2. The comprehensive set of contextual survey instruments allow us to reveal the complex set of interacting factors that influence students’ wellbeing as digital citizens, following the Bronfenbrenner ecological model of child development. These findings have significant implications for research as well as for parenting, family services, curriculum, and pedagogy. The research team has already been approached by a major charity in HK to develop a major R&D project that is likely to extend for five years and beyond to underpin the intervention work of many charities, NGOs, tertiary institutions, edtech companies and to inform government policy.
3. The work on the development of collaborative online games for fostering cyberwellness and for the learning and assessment of collaborative problem solving will be able to bear fruit in the coming one to two years.
4. Likewise, the development of multimodal methods understand digital learning lives will be able to demonstrate more significant results in the coming one to two years as the PhD student working in the area graduates.
5. The work on developing innovative elearning tools employing AR and VR technologies as well as learning analytics and visualization applications have a focus on supporting a variety of learning: socioemotional, kinesthetic, as well as cognitive and metacognitive for learners will have more opportunities to demonstrate their relevance in supporting the learning of digital citizens if given some more time.
6. Very importantly, the project has stimulated deeper understanding and interests from a wide range of stakeholders, particularly those within or connected with the education sector about digital citizenship, and their recognition of the importance of this type of research for the well-being of children and youth, parents, and families, as well as the society at large. The interdisciplinarity of the project and the wide range of expertise

engaged has helped to galvanize the public in their support for this research and will have significant impact in the years to come.

6.3 If the project has not met its original objectives, why?

All of the targeted objectives have been fully realized except for objective 4. In fact, we have accomplished more than what we set out to do in our initial proposal by approximately 20%. The 4th objective of the project has not been completed. As stated in point 3, the project team has developed a mobile multiplayer online game called D-City Fighter to foster digital citizenship, focusing on the collaborative problem-solving skills for selected prototypical, age-appropriate contexts for cohort 1 and 2 students. The game was re-developed based on in-depth, primarily qualitative empirical studies, and the game's age-appropriateness has been validated through cognitive interviews, a pilot study, and consultation with education experts and teachers.

The main data collection was supposed to be completed in 2022. However, due to the fifth wave of the COVID-19 pandemic and the social distance restriction imposed by the government, we were unable to collect enough samples. Many teachers are reluctant to release time for their students to "play games" as resumption of normal school schedule only took place in early 2023 in Hong Kong. The main data collection has therefore been postponed. This part of the study is expected to be completed by August 31, 2023. We are collaborating with the Hong Kong Playground Association to recruit primary school students to participate in this study.

6.4 (a) Please provide details of each peer-reviewed journal publication arising directly from this project by completing the table at **Annex** (one for each publication).

Please refer to Annex.

(b) Please provide details of recognised international conference(s) in which paper(s) related to this project was/were delivered by completing the following table: (Please attach a copy of each conference abstract)

	Month/Year/ Place	Title	Conference name	Year submitted to RGC	Attached to report (Y/N)	Acknowledged RGC (Y/N)	Access. fr. inst. reposi (Y/N)
C1	04/2017/ Seoul, South Korea	Li, Q., Shen, Q., Ming, Y., Xu, P., Wang, Y., Ma, X., & Qu, H, <i>A Visual Analytics Approach for Understanding Egocentric Intimacy Network Evolution and Impact Propagation in MMORPGs</i> . DOI: 10.1109/PACIFICVIS.2017.8031576	IEEE Pacific Visualization Symposium (PacificVis 2017)	Stage 2 - 2018	Yes	Yes	No
C2	10/2017/ Brighton, UK	Thanyadit, S. & Pong, T.C. <i>Desktop VR using a Mirror Metaphor for Natural User Interface</i> https://doi.org/10.1145/3132272.3134131	ACM International Conference on Interactive Surfaces and Spaces	Stage 2 - 2018	Yes	Yes	No
C3	11/2017/ Bangkok, Thailand	Thanyadit, S. & Pong, T.C. <i>User interface applications in desktop VR using a mirror metaphor</i> https://doi.org/10.1145/3145690.3145716	SIGGRAPH Asia 2017	Stage 2 - 2018	Yes	Yes	No
C4	07/2018/ Hong Kong	Li, Q., Wu, Z., Xu, P., Qu, H., & Ma, X. A., <i>Multi-Phased Co-design of an Interactive Analytics System for MOBA Game Occurrences</i> doi:10.1145/3196709.3196771"	ACM Designing Interactive Systems Conference 2018 (ACM DIS 2018)	Stage 2 - 2018	Yes	Yes	No
C5	05/2018/ New York, USA	Sun, Z., Han, F., & Ma, X. <i>Exploring the Effects of Scale in Augmented Reality-Empowered Visual Analytics</i> . ACM, Paper LBW012, 6 pages. DOI: 10.1145/3170427.3188551"	CHI Conference on Human Factors in Computing Systems (CHI EA '18)	Stage 2 - 2018	Yes	Yes	No

	Month/Year/ Place	Title	Conference name	Year submitted to RGC	Attached to report (Y/N)	Acknowledged RGC (Y/N)	Access. fr. inst. repository (Y/N)
C6	04/2018/ Washington, D.C	Ng, E., Law, N. & Yuen, A. <i>Understanding Learner Lives Through Digital Footprints</i> doi: 10.1145/3183654.3183708	Technology, Mind and Society — A conference sponsored by APA	Stage 2 - 2018	Yes	Yes	No
C7	09/2018/ Paris, France	Hu, X., Li, F., & Ng, J. <i>On the Relationships between Music-induced Emotion and Physiological Signals</i>	19th International Society for Music Information Retrieval Conference (ISMIR)	Stage 2 - 2018	Yes	Yes	Yes
C8	11/2018/ New York, USA	Thanyadit, S., Punpongsanon P., & Pong, T.C., <i>Efficient Information Sharing Techniques between Workers of Heterogeneous Tasks in 3D CVE</i> https://doi.org/10.1145/3274441	21st ACM Conference on Computer-Supported Cooperative Work and Social Computing	Stage 3 - 2019	Yes	Yes	Yes
C9	03/2019/ Baltimore, MD, USA	Mirpuri, S., Rao, N., & Law, N. (2019). <i>Conceptualizing digital citizenship: An integrative review (poster)</i>	Biennial meeting of the Society for Research in Child Development Conference	Stage 3 - 2019	Yes	Yes	No
C10	03/2019/ Osaka, Japan	Thanyadit, S., Punpongsanon P., & Pong, T.C., <i>Investigating Visualization Techniques for Observing a Group of Virtual Reality Users using Augmented Reality</i> DOI: 10.1109/VR.2019.8798123	26th IEEE Conference on Virtual Reality and 3D User Interfaces	Stage 3 - 2019	Yes	Yes	No
C11	04/2019/ Toronto, Canada	Liang, Q., & de la Torre, J. <i>Estimation of Partially Defined Q-Matrix</i>	National Council on Measurement in Education	Stage 3 - 2019	Yes	Yes	No
C12	05/2019, HK, China	Zhang, D., Hossain, L., Law, N., Fu, K., Lu, Z., & Chan, A. Predicting cyberbullying consequences from cyberbullying behavior.	CITE Research Symposium 2019	Stage 6 - 2022	Yes	Yes	No
C13	05/2019, HK, China	Li, Q., Sun, D., & Qu, H. D-city fighters: A collaborative problem solving game for education.	CITE Research Symposium 2019	Stage 6 - 2022	Yes	Yes	No
C14	05/2019, Hong Kong, China	Tsang, H. W. C., & Law, N. Exploring the development of a conceptual serious game design framework for in-game assessment of collaborative problem solving (CPS) in coping with cyberbullying.	CITE Research Symposium 2019	Stage 6 - 2022	Yes	Yes	No
C15	05/2019, HK, China	Cagasan, L., Liang, Q., & de la Torre, J. Exploring the psychometric properties of a digital citizenship digital literacy assessment.	CITE Research Symposium 2019	Stage 6 - 2022	Yes	Yes	No
C16	06/2019/ Lyon, France	Tsang, H. W. C., Park, S. W., Chen, L. L., & Law, N. W. Y. <i>Assessing collaborative problem solving: What and how?</i> https://repository.isls.org/handle/1/1598	The International Conference on Computer-Supported Collaborative Learning 2019	Stage 3 - 2019	Yes	Yes	Yes
C17	07/2019/ Santiago, Chile.	de la Torre, J., Liang, Q., Cagasan, L., Jin, K.-Y., Reichert, F., & Law N. <i>A cognitive diagnosis model analysis of a digital literacy assessment.</i>	84th annual meeting of the Psychometric Society	Stage 3 - 2019	Yes	Yes	No
C18	08/2019/ Aachen, Germany	Chan, F. H. F., Yuen, A. H. K, Li, Q., Lam, E. Y., & Tam, V. W. L. <i>Exploring classroom dynamics in a university setting: A multilevel modelling approach</i>	The 18th Biennial EARLI Conference 2019	Stage 3 - 2019	Yes	Yes	No
C19	08/2019/ Washington, DC, USA	Reichert, F. <i>Teacher's Goals of Civic Education, Classroom Practices and Student Engagement</i>	American Political Science Association 2019	Stage 3 - 2019	Yes	Yes	No
C20	08/2019, Tokyo, Japan	Chan, F., Yuen, A. Secondary Students' ICT Usage Patterns and Digital Divide: A Cohort Perspective.	World Education Research Association (WERA) 2019 Focal Meeting	Stage 6 - 2022	Yes	Yes	No

	Month/Year/ Place	Title	Conference name	Year submitted to RGC	Attached to report (Y/N)	Acknowledged RGC (Y/N)	Access. fr. inst. repository (Y/N)
C21	11/2019/ Portland, Oregon, USA	Zhou, Z.*, Tam, V., Lui, K.S. Hu, X., Yuen, A., Law, N. <i>Applying Deep Learning for Real-time Classroom Activities Recognition based on Wearable Devices</i> . DOI: 10.1109/ICTAI.2019.00124	2019 IEEE 31st International Conference on Tools with Artificial Intelligence (ICTAI).	Stage 4 - 2020	Yes	Yes	No
C22	11/2019/ Beijing, China	Thanyadit, S., Punpongsanon P., & Pong, T.C., <i>ObserVAR: Visualization System for Observing Virtual Reality Users using Augmented Reality</i> . DOI: 10.1109/ISMAR.2019.00023	IEEE ISMAR 2019 18th IEEE International Symposium on Mixed and Augmented Reality	Stage 4 - 2020	Yes	Yes	No
C23	12/2019/ San Diego, CA, USA	Zhao, Z., Han, F., & Ma, X.* <i>A Live Storytelling Virtual Reality System with Programmable Cartoon-style Emotion Embodiment</i> . DOI: 10.1109/AIVR46125.2019.00024	3rd International Conference on Artificial Intelligence & Virtual Reality	Stage 4 - 2020	Yes	Yes	Yes
C24	01/2020/ Hawaii, USA	Kong, R., Hu, X., Yuen, A. <i>Understanding academic engagement through multimodal learning analytics</i> DOI:10.24251/HICSS.2020.411.	2020 Hawaii International Conference on System Sciences	Stage 4 - 2020	Yes	Yes	Yes
C25	03/2020 (Online: COVID-19)	Li, F., Hu, X. & Que, Y. <i>Learning with Background Music: A Field Experiment</i> . https://doi.org/10.1145/3375462.3375529	10th International Conference on Learning Analytics & Knowledge	Stage 4 - 2020	Yes	Yes	No
C26	04/2020/ Hawaii, USA	Lin, C-e., Cheng T. Y., & Ma, X. <i>ARchitect: Building Interactive Virtual Experiences from Physical Affordances by Bringing Human-in-the-Loop</i> https://doi.org/10.1145/3313831.3376614	Conference on Human Factors in Computing Systems - ACM CHI2020	Stage 4 - 2020	Yes	Yes	No
C27	04/2020 SFO CA, USA (cancelled: COVID-19)	Jin, K.-Y., Reichert, F., Cagasan, L., de la Torre, J., & Law, N. <i>Measuring digital literacy across three age cohorts: Exploring the dimensionality and performance differences</i> http://tinyurl.com/uktk4uh	American Educational Research Association 2020	Stage 4 - 2020	Yes	Yes	No
C28	04/2020 SFO CA, USA (cancelled: COVID-19)	Reichert, F. Wong, M., Ma, K., & Fu, K-w. <i>Differential paths to online versus offline civic participation: Testing a behavioral model explaining civic participation</i> http://tinyurl.com/wsrkpsm	American Educational Research Association 2020	Stage 4 - 2020	Yes	Yes	No
C29	06/2020/ Nashville, TN, USA (online)	Tsang, H. W. C., Liu, Y. M., & Law, N. W. Y. <i>An in-depth study of assessment of collaborative problem solving (CPS) skills of students in both technological and authentic learning settings</i>	The International Conference of the Learning Sciences 2020	Stage 4 - 2020	Yes	Yes	No
C30	06/2020/ Rhodes, Greece (postponed)	Chen, L. L., Rao, N., & Law, N. <i>Digital competence in primary and secondary school students: A cross-sectional study in the Hong Kong context</i>	26th Biennial Meeting of the International Society for the Study of Behavioural Development 2020 + 2	Stage 4 - 2020	Yes	Yes	No
C31	06/2020/ Rhodes, Greece (postponed)	Liang Q., de la Torre J., Law N. <i>Children's mastery of digital literacy and its variations by background characteristics in Hong Kong: A cognitive diagnosis model analysis</i>	26th Biennial Meeting of the International Society for the Study of Behavioural Development 2020 + 2	Stage 4 - 2020	Yes	Yes	No
C32	07/2020/ Berlin (Withdrawn)	Reichert, F., <i>Patterns of citizenship norms and associations with political participation in Hong Kong: A person-centered analysis</i>	International Society of Political Psychology 2020	Stage 4 - 2020	Yes	Yes	No

	Month/Year/ Place	Title	Conference name	Year submitted to RGC	Attached to report (Y/N)	Acknowledged RGC (Y/N)	Access. fr. inst. repository (Y/N)
C33	07/2020/ Santiago de Compostela, Spain (postponed)	Wong, M. & Reichert, F. <i>Exploring online and offline civic participation among university students: Comparison between local and international students in Hong Kong</i>	World Education Research Association 2020+1	Stage 4 - 2020	Yes	Yes	No
C34	07/2020/ Lisbon, (postponed)	Reichert, F., <i>Teachers' Beliefs about Civic Education and Associations with Classroom Instruction and Students' Civic Engagement: The Case of Hong Kong</i>	World Congress of Political Science 2020	Stage 4 - 2020	Yes	Yes	No
C35	07/2020 Tartu, Estonia	Zhou, Z. X., Tam, V., Lui, K. S., Lam, E. Y., Hu, X., Yuen, A., & Law, N. A Sophisticated Platform for Learning Analytics with Wearable Devices. https://doi.org/10.1109/ICALT49669.2020.00097	2020 IEEE 20th International Conference on Advanced Learning Technologies (ICALT). IEEE.	Stage 6 - 2022	Yes	Yes	No
C36	11/2020, online	S. Thanyadit, P. Punpongsanon, T. Piumsomboon and T.C. Pong. <i>Substituting Teleportation Visualization for Collaborative Virtual Environments</i> https://doi.org/10.1145/3385959.3422698	ACM Spatial User Interaction Conference	Stage 5 - 2020	Yes	Yes	No
C37	11/2020, online	P.M. Fan and T.C. Pong. <i>A framework for scalable tracking of physical objects to enhance immersive prototyping for design thinking</i> https://doi.org/10.1145/3385959.3422700	ACM Spatial User Interaction Conference	Stage 5 - 2020	Yes	Yes	No
C38	11/2020, Hong Kong, China	Wong, R. S., Tung, K., Law, N., & Ip, P. <i>Digital literacy correlates with decreased game addiction symptoms and cyberbullying in school-aged children and adolescents.</i>	Joint Annual Scientific Meeting of the HK Paediatric Society, HK College of Paediatricians, HK Paediatric Nurses Association HK College of Paediatric Nursing	Stage 6 - 2022	Yes	Yes	No
C39	01/2021, online	Reichert, F. <i>Social Identity, Grievances, and Political Protest: Understanding Hong Kong Students' Protest Behavior.</i>	Annual Meeting of the Southern Political Science Association, New Orleans (LA)	Stage 6 - 2022	Yes	Yes	No
C40	08/2021, online	Tso, W. W. Y., Fu, K.W., Rao, N., Wong, I. C. K., Wong, W. H. S., Reichert, F., Leung, L. K., Feng, S., & Law, N. W. Y. <i>Digital Social Capital and Well-being of Digital Citizens.</i>	European Association for Research on Learning and Instruction (EARLI) Biennial Conference 2021.	Stage 6 - 2022	Yes	Yes	No
C41	08/2021, online	Hu, X., Kong, R., & Law, N. W. Y. <i>Student well-being during COVID: Navigating through different phases of school suspension.</i>	European Association for Research on Learning and Instruction (EARLI) Biennial Conference 2021.	Stage 6 - 2022	Yes	Yes	No
C42	08/2021, online	Tan, C. Y., Pan, Q., Zhang, Y., Lan, M., Lam, P., & Law, N. W. Y. <i>Students' learning experiences during COVID-19 and familial SES.</i>	European Association for Research on Learning and Instruction (EARLI) 2021 Biennial Conference.	Stage 6 - 2022	Yes	Yes	No
C43	06/2021, online	Reza Hadi Mogavi, Yankun Zhao, Ehsan Ul Haq, Pan Hui, and Xiaojuan Ma. <i>"Student barriers to active learning in Synchronous online classes: Characterization, reflections, and suggestions."</i> DOI:10.1145/3430895.3460126	The Eighth ACM Conference on Learning@ Scale	Stage 6 - 2022	Yes	Yes	Yes
C44	06/2021, online	Liang, Q., Santos, K. C., Tjoe, H., & de la Torre, J. (Jun 2021). <i>Context matters: A comparison of empirical CDM analyses involving two different Q-matrices.</i>	Annual Meeting of the National Council on Measurement in Education (NCME)	Stage 6 - 2022	Yes	Yes	No

	Month/Year/ Place	Title	Conference name	Year submitted to RGC	Attached to report (Y/N)	Acknowledged RGC (Y/N)	Access. fr. inst. repository (Y/N)
C45 C46	10/2021, online	Kim, Taewook, Hyunwoo Kim, Juho Kim, and Xiaojuan Ma. "Improving Readers' Awareness of Divergent Viewpoints by Displaying Agendas of Comments in Online News Discussions." https://doi.org/10.1145/3462204.3481761	Poster at the 2021 Conference on Computer Supported Cooperative Work and Social Computing	Stage 6 - 2022	Yes	Yes	Yes
C46 C47	10/2021, online	Peng, Zhenhui, Chuhan Shi, and Xiaojuan Ma. "Exploring User Experience and Design Opportunities of Desktop Social Virtual Reality for Group Learning Activities." https://doi.org/10.1145/3490355.3490367	The Ninth International Symposium of Chinese CHI	Stage 6 - 2022	Yes	Yes	No
C47 C48	10/2021, online/ Salt Lake City, UT	Shihui Feng, Mengqian Li, Ola Erstad. "Social Connections Matter: Online and Offline Civic Engagement among College Students" https://doi.org/10.1002/prs2.442	Proceedings of the Association for Information Science and Technology	Stage 6 - 2022	Yes	Yes	Yes
C48 C49	04/2022, online	Laixin Xie, Ziming Wu, Peng Xu, Wei Li, Xiaojuan Ma, and Quan Li. "RoleSeer: Understanding Informal Social Role Changes in MMORPGs via Visual Analytics."	CHI Conference on Human Factors in Computing Systems	Stage 6 - 2022	Yes	Yes	Yes
C49 C50	04/2022, online	Tan, C. Y., Pan, Q., Zhang, Y., Lan, M., & Law, N. (2022). <i>Socioeconomic status, parental involvement, and student outcomes during COVID-19 school suspension in Hong Kong.</i>	American Educational Research Association 2022 Annual Meeting	Stage 6 - 2022	Yes	Yes	No
C50 C51	04/2022, online	Tao, S., & Reichert, F. (2022, April). <i>Digital Usage and Cyberbullying Among Primary School Children: Digital Literacy and Parental Mediation as Moderators.</i>	World Education Research Association Focal Meeting (held in conjunction with the AERA Annual Meeting)	Stage 6 - 2022	Yes	Yes	No
C51 C52	04/2022, San Diego, CA. USA	Liang, Q., de la Torre, J., & Law, N. [R1] (2022). <i>Assessing Hong Kong Students' Digital Literacy Using a Multiple-group CDM: A Cross-sectional Study.</i>	Annual Meeting of the National Council on Measurement in Education (NCME)	Stage 6 - 2022	Yes	Yes	No
C52 C53	04/2022, online	Liang, Q., de la Torre, J., & Law, N. (2022). <i>Latent Transition Cognitive Diagnosis Model with Covariates: A Three-step Approach.</i>	Annual Meeting of the National Council on Measurement in Education (NCME)	Stage 6 - 2022	Yes	Yes	No
C53 C55	11/2022, online	Ko, Man Ching, and Xiaojuan Ma. "Mobilizing Instrumental Childcare Support for Postpartum Mothers: Needs for and Barriers to Infant-centric Family Informatics Practices in Hong Kong." https://doi.org/10.1145/3555084	The 2022 Conference on Computer Supported Cooperative Work and Social Computing	Stage 6 - 2022	Yes	Yes	No
C54 C56	03/2023, Texas, USA	Ng, J., Liu, Y, Chui, D. S. Y., Man, J. C. H. & Hu, X. (2023). <i>Leveraging LMS Logs to Analyze Self-Regulated Learning Behaviors in a Maker-based Course.</i> https://doi.org/10.1145/3576050.3576111	LAK23: 13th International Learning Analytics and Knowledge Conference	Stage 6 - 2022	Yes	Yes	Yes
C55 C57	03/2023, Salt lake city, USA	Chen, L., & Rao, N. (2023). <i>Stability and change in digital technology use: A longitudinal study of primary school students.</i>	Society for Research in Child Development 2023 Biennial Meeting	Stage 6 - 2022	Yes	Yes	No

- (c) RGC funding should have been acknowledged in all publication(s)/conference papers listed in (a) and (b) above. If no acknowledgement has been made in any of the publications/ papers, please indicate and provide explanations.

Not applicable. We acknowledged in all publications/conference papers.

6.5 To what extent this project has strengthened inter-institutional collaborations and other partnerships?

The project would not have been successfully completed without the strengthened inter-institutional collaborations between HKU and HKUST through following:

1. *Co-planning meetings*: The project team members from the two universities met regularly for joint planning meetings to discuss project design and implementation.
2. *Seminars and workshops*: The project team regularly organises research seminars and workshops to share research results with each other.
3. *Conferences*: The members of the project team from the two universities attended academic conferences together (e.g., The 5th China Education Innovation Expo, Zhuhai, China).
4. *Research students*: The project promotes collaboration between research students from the two universities. For example, four research students, Dr Quan Li (graduated, HKUST), Dr Haley Tsang (graduated, HKU), Mr Yiming Liu (HKU) and Mr Kenny Ma (HKUST), worked together on the design, implementation and exploitation in educational studies of the online collaborative problem-solving game.
5. *Research instruments*: Project team members from the two universities worked together to develop and maintain the digital literacy assessment tool. Members of the HKU team designed the items and conducted the analysis, while members of HKUST assisted with their technological deployment as well as for the monitoring and maintenance of the system and the database.

The project has initiated and maintained the collaborations with local schools and NGOs:

1. *Local schools*: The project team regularly organises press conferences, seminars and workshops for head teachers and teachers to share the research findings to support schools. More than 120 individual school reports were sent to participating schools, containing descriptions and statistics about the situation of the respective school as well as suggestions for practice. Case studies were carried out in several participating schools and the results in the reports of the individual schools were discussed in detail by the school leaders and members of the project team.
2. *NGOs*: The project team maintains a good collaboration with local NGOs. For example, the project team has received external funding from a local NGO (Boys and Girls Clubs Association) to use digital literacy assessment to evaluate the effectiveness of a coding programme to improve the digital literacy of primary school students. Another example is the collaboration with the Hong Kong Playground Association to offer an online course against cyberbullying to local schools.

The project also established collaborations with international projects sharing a similar interest:

1. *Digital Citizenship Plus Seminar Series*: The project team organised six seminars together with researchers from international institutions/organisations to facilitate knowledge transfer and academic communication (<https://ecitizen.hk/dc-plus-seminars>)
 2. *Others*: The project team initiated close collaborations with the GenZ project (University of Oulu) and the Horizon 2020 funded project Digigen. The PC is one of the international advisory committee member of Digigen (<https://www.digigen.eu/international-advisory-committee/>).
-

6.6 Research students trained (registration/awards):

Name	Degree registered for	Date of registration	Date of thesis submission/ graduation
LIANG Qianru	PhD	September-2017	August-2021/ March-2022
TSANG Wing Chi, Haley	PhD	November-2017	October-2020/July-2021
KONG Runzhi, Molly	PhD	September-2017 (TRS support from 2 nd to 4 th years)	May-2022/revised: January-2023
CHAN Hing Fong, Fred	PhD	May-2018	April-2022/October-2022
CHEN Lu, Laure	PhD	September-2018	August-2022/December-2022
ZHOU Zhenxing	PhD	October-2018	September-2022
CHENG Shu	PhD	September-2019 (TRS support till Aug-2022)	August-2023
LIU Yiming	PhD	September-2019 (TRS support till Aug-2022)	August-2023
SANTAWAT Thanyadit (HKUST)	PhD	August, 2014	June-2019
LI Quan (HKUST)	PhD	August, 2015	December, 2018
ZHAO Zhenjie (HKUST)	PhD	August, 2016	August, 2020
MA Zhengyang (HKUST)	M.Phil.	August, 2019	August, 2021

6.7 Specific products (e.g. software or netware, instruments or equipment developed):

1. **Digital Literacy Assessment (Instrument):** The project team has developed a valid and reliable computer-based performance assessment for digital citizenship literacy for students aged from 7 to 18.
2. **D-City Fighter (Instrument & Online game):** The project team has developed a mobile multiplayer online game to foster digital citizenship, focusing on the collaborative problem-solving skills for selected prototypical, age-appropriate contexts for cohort 1 and 2 students.
3. **Anti-Cyberbullying online course:** The project team designed an anti-cyberbullying online course to educate students what cyberbullying is and why it has a negative impact on wellbeing.
4. **e360 Instruments:** The project team developed a series of instruments to measure the impact of COVID-19 on student learning and well-being, as well as on instruction and leadership of school leaders and teachers.

6.8 Other education activities and/or training programmes developed:

1. **Anti-Cyberbullying online course:** The project designed an anti-cyberbullying online course. We collaborated with Hong Kong Playground Association to offer anti-cyberbullying online course to local schools.
2. **Seminars and workshops:** The project team regularly organize press conferences, seminars, and workshops for school leaders and teachers to share the research findings as a support to schools.
3. **Knowledge Transfer activities:** The project team members organised lectures, seminars and workshops as part of the knowledge transfer activities organised by the faculty to disseminate the research results to the community.

6.9 Please highlight any deliverables indicated in the project implementation timetable endorsed by the RGC which have not been covered or achieved as per sections 6.1 to 6.8 above, and explain/ elaborate.

Not applicable.

Project Management

6.10 Please elaborate how the PC has played his/her role in coordinating and managing the project.

The PC has coordinated and managed the project in following actions:

1. *Research*

- Directed and monitored the implementation of the research protocol approved by TRS
- Obtain informed Consent from schools, teachers, students, and parents.
- Effectively train and mentor research staffs and research students in the ethical conduct of research.
- Regularly report project progress to RGC
- Initiated and maintained the inter-institutional collaboration between HKU and HKUST
- Responded promptly to all concerns and questions from the schools and project teams.
- Organized and led meetings with the international advisory committee.
- Organized and led meetings with the local advisory committee as well as liaise and consult members regarding knowledge exchange plans and activities.
- Managed the budget, staff appointments, and other human resource responsibilities.
- Led the development of the funding proposals and project management for two additional funded projects: eCitizen Education 360 (2020 and 2022) (details at <https://www.ecitizen.hk/360/>)

2. *Knowledge transfer*

- Organize press conferences to share the research findings to the community.
- Led the preparation of individual school reports.
- Led the preparation of project general reports and bulletins.

7. Awards and Recognition

7.1 Have any research grants been awarded that are directly attributable to the results obtained from this project?

Project team members have variously been awarded the following research grants that are off-shoot projects directly attributable to the outcomes of the TRS-funded project:

1. **Project Title:** Digital Literacy Assessment: a background report for the UNESCO Global Education Monitoring Report 2023. *PI:* Dr Frank Reichert, administered through the Centre for Information Technology in Education. *Funded by* UNESCO (France: USD9,000.00) (04/2022 - 09/2022)
2. **Project Title:** eCitizen Education 360 - an Action Focused Post-COVID-19 Study for Equitable Quality Education for All. *PI:* Prof Nancy Law. *Advisor:* Prof Catherine Chan. *Co-PI:* Dr Cheng Yong Tan. *Co-Is:* Dr Min Lan, Dr Qianqian Pan. *Funded by* Jockey Club Self-directed Learning in STEM Programme (Hong Kong SAR: HK\$1,037,750.00)

(06/2020-12/2020)

3. **Project Title:** eCitizen Education 360 (2022): An extension of the Learning and Assessment for Digital Citizenship project. *PI:* Dr Cheng Yong Tan. *Co-Is:* Prof Nancy Law, Prof Catherine Chan, Dr Min Lan, Dr Qianqian Pan, Dr Sisi Tao. *Funded by* The D. H. CHEN Foundation (Hong Kong SAR: HK\$1,500,000.00) (06/2022-06-2023)
4. **Project Title:** Digital citizenship education. *PI:* Dr Frank Reichert. *German collaborator Co-PI:* Prof. Dirk Lange, University of Hannover. *Funded by* Germany/Hong Kong Joint Research Scheme, UGC (Hong Kong SAR: HK\$73,500.00) & DAAD (Germany: €13,970.00) (01/2020-12/2021)
5. **Project Title:** Collective Identification and the Protest Movement in Hong Kong. *PI:* Dr Frank Reichert. *Co-Is:* Dr Wong Pui Shan Mona, Prof Fu King Wa, Prof Nancy Law. *Funded by* Public Policy Research (PPR) Funding Scheme (Hong Kong SAR: HK\$466,867.00) (04/2020-11/2020)
6. **Project Title:** Students' Assessments of Credibility in Online Environments: Assessment Criteria, Influencing Factors, and Skills for Citizenship in the Digital Age. *PI:* Dr Frank Reichert. *Co-PI:* Dr. Monika Oberle, Georg-August-University of Göttingen. *Funded by* Germany/Hong Kong Joint Research Scheme, UGC (Hong Kong SAR: HK\$89,500.00) & DAAD (01/2023-12/2024)
7. **Project Title:** A Pilot Trial for the Evaluation of a Coding Program to Improve Digital Literacy of Primary School Students from Low Socioeconomic Background in Hong Kong: An Extension of the Learning and Assessment for Digital Citizenship Project. *PI:* Prof Nancy Law. *Co-I:* Dr Sisi Tao. *Funded by* Boys and Girls Clubs Association (Hong Kong SAR: HK\$8,500.00) (10/2022-03/2023)
8. **Project Title:** Validation and Implementation of a Performance-based Assessment Tool Measuring Digital Literacy in University Students. *PI:* Dr Sisi Tao. *Co-Is:* Prof Nancy Law, Dr Qianru Liang, Dr Qianqian Pan. *Funded by* HKU Faculty of Education Faculty Research Fund 42nd Round (2022-23) (Hong Kong SAR: HK\$60,000.00) (12/2022-08/2023)
9. **Project Title:** Assessing and comparing students' digital literacy skills before and during COVID-19: A longitudinal cognitive diagnosis model analysis. *PI:* Dr Qianru Liang. *Co-Is:* Prof Nancy Law, Prof Jimmy de la Torre, Dr Qianqian Pan, Dr Sisi Tao, Mr Zechu Feng. *Funded by* HKU Faculty of Education Faculty Research Fund 42nd Round (2022-23) (Hong Kong SAR: HK\$60,000.00) (12/2022-08/2023).

7.2 Have any project team members participated as invited speakers in or organisers of international conferences as a result of this project?

The project coordinator and other project team members have been invited as speakers in following international conferences because of this project:

1. Law, N. W. Y. (2021, November 7). 香港學作為數碼公民的學習生活:現狀與未來 (The learning lives of Hong Kong students as digital citizens: the status quo and the future). Invited talk at the *4th World Education Frontiers Forum*. <https://mp.weixin.qq.com/s/w04gOYtAPUdhIupA66PSYg>
2. Law, N. W. Y. (2021, March 24). An Action-focused Community-based Study during COVID-19 for Equitable Quality Education for All. Invited presentation at the *UN Commission on the Status of Women (UNCSW) 65th session* parallel event organized by the HK Federation of Women (HKFW). Session theme was Hong Kong Women in the Time of the Pandemic.
3. Law, N. W. Y. (2021, January 26). Expanding Science of Learning Research to Multilevel Aligned Learning: Studying online learning preparedness of students, teachers, school leaders and the community in HK during COVID19. Invited talk at the *Forum for World Education: Lessons from How People Learn II: Opportunities and Imperatives for Education in a Post-COVID World*. <https://www.fweforum.org/event/fwe-webinar-lessons-on-how-people-learn-ii-opportunities-and-imperatives-for-education-in-a-post-covid-world>

4. Law, N. W. Y. (2020, November 30). Sparking a multilevel learning epidemic through action-oriented research during COVID-19. Invited talk for the *New Education Normal Webinar Series* hosted by the National Institute of Education (NIE), Nanyang Technological University. <https://www.nie.edu.sg/about-us/news-events/news/news-detail/new-education-normal-webinar-series-sparking-a-multilevel-learning-epidemic-through-action-oriented-research-during-covid-19>
5. Law, N. W. Y. (2020, November 21). 透過行動為本的疫下研究激發多層次『傳染式學習』. Invited talk at the *3rd World Education Frontiers Forum*. <https://mp.weixin.qq.com/s/UvjBAVHb6UGY3QN74GCWmg>
6. Reichert, F. (2021, July). Moral and Civic Education During the Pandemic and Its Challenges. Plenary talk at the 15th Annual Conference of the Asia-Pacific Network for Moral Education (Online).
7. Hu, X. (2023, January). Multimodal Learning Analytics and Its Applications in Secondary and Adult Education, Artificial Intelligence In Education Talks, National Institute of Education, Nanyang Technological University, Singapore. (Online)
8. Hu, X. (2022, December). Information Research for Improving Learning and Wellbeing, Keynote, Annual Meeting of Asia Pacific Chapter Association for Information Science and Technology (ASIS&T). (Online)
9. Hu, X. (2022, December). Music Recommendation for Learning and Well-being, Women in Music Information Retrieval Plenary Session, Bengaluru, India.
10. Hu, X. (2019, August). Multimodal Learning Analytics: An Interdisciplinary Agenda”, University of California at San Diego.
11. Hu, X. (2019, June). Multimodal Learning Analytics”, Learning Design, Technology and the Learning Sciences: A Research Colloquium”, International Society of the Learning Sciences (ISLS), Beijing Normal University

-
- 7.3 Have any project team members taken leadership positions in editorial boards, scientific and professional organisations?

Prof Nancy Law:

1. Associate Editor, *npj Science of Learning* (2018 – 2022)
2. Executive Editor, *International Journal of Computer-Supported Collaborative Learning* (2013 – present)
3. Expert, European Commission Joint Research Centre Technical Workshop on DigComp 2.2 (2021)
4. Member, UNESCO Global Education Monitoring Report Advisory Board (2021 – 2023)
5. International Advisory Committee (2020 – 2022),
6. Member, Educational Research Funding Programme (ERFP) Expert Panel, Nanyang Technological University (2019)
7. Member, Judging Panel, HKICT Awards 2019: Smart People Award (2019)
8. Member, Scientific Advisory Committee, Centre for Research on Learning and Innovation Uni of Sydney (2016 – 2019)
9. Member, Scientific Advisory Committee, SLATE-Centre for the Science of Learning & Technology University of Bergen (2016 – 2021)
10. Member, Humanities and Social Sciences Panel of the HKSAR Research Grants Council (RGC) (2022-2025).

Prof Nirmala Rao:

1. Member, Advisory Committee of ECD Massive Open Online Course (MOOC), Harvard, UNICEF, HarvardX (2019-2020)

2. Co-Chair, Knowledge Fellow Steering Committee, Early Childhood Development Action Network (ECDAN) (2019 – Present)
3. Member, Advisory Group, Early Childhood Workforce Initiative, ISSA and R4D, Netherlands (2018 – Present)
4. Member, Thematic Group on Early Childhood Care and Education Teachers and Facilitators (TG-ECCE) of the International Taskforce on Teachers for Education 2030 (TTF), UNESCO (2018 – Present)
5. Member, Advisory Board, South Asia Forum of Early Childhood Development Professionals (SAFECDP) (2018 – Present)
6. Member, Vetting Committee of SCOLAR's Research and Development Projects (2017 – Present)

Prof King-wa Fu:

1. Member, Global Future Council on Media, Entertainment and Culture, World Economic Forum (2019 – 2020)
2. Honorary Fellow, HKJC Centre for Suicide Research and Prevention, HKU
3. Adjudicator, Consumer Rights Reporting Awards 2014-now, Consumer Council.
4. Member of Standing Committee, HKU Convocation (2017 – 2020)
5. Convenor, University affair sub-committee, HKU Convocation (2017 – 2020)
6. HKU Court Member (2018 – Present)
7. Deputy Director, Journalism and Media Studies Centre (2016 – Present)

Prof Jimmy de la Torre:

1. Associate Editor, *Applied Psychological Measurement* (2012 – present)
2. Associate Editor, *Frontiers in Education* (2020 – present)
3. Consulting Editor, *Educational Psychology: International Journal of Experimental Educational Psychology* (2016 – present)
4. Editor-in-Chief, *Journal of Educational Measurement* (2014 – 2016)
5. Member, Psychometric Society Board of Trustees (2016 – 2018; 2021 – 2023)
6. Chair, AERA SIG Cognition and Assessment (2021 – 2024)

Dr. Patrick Ip:

1. Management Committee Board Member, Boys' and Girls' Clubs Association of Hong Kong (2011 – now)

Dr. Michael Chau:

1. Program Co-chair, Pacific-Asia Conference on Information Systems (PACIS 2024)
2. Program Co-chair, IEEE International Conference on Intelligence and Security Informatics (ISI 2019)

Dr. Xiao Hu:

1. Guest Editor, Special Issue on Crowdsourcing and Collaboration in Digital Humanities, *Aslib Journal of Information Management* (2019)
2. Track program co-chair, IEEE International Conference on Advanced Learning Technologies (ICALT) (2017 – 2020)
3. Program co-chair, International Society for Music Information Retrieval Annual Conference (ISMIR) (2017 & 2018)
4. Board Member, The Society of International Chinese in Educational Technology (SICET) (2018 – 2021)
5. Mentor, Women in Music Information Retrieval (WiMIR) mentorship programme (2016 – 2018)

Dr. Edmund Lam:

1. Chair, Image Sensing and Pattern Recognition Technical Group, Optica (formerly OSA) (2017 – 2019)
2. Associate Editor, IEEE Transactions on Biomedical Circuits and Systems (2007 – present)
3. Senior Area Editor and Associate Editor, IEEE Signal Processing Letters (2018 – present; 2014 – 2017)
4. Guest Editor, Optics Express (2020)
5. Guest Editor, Applied Optics (2019)
6. Founder and Co-Chair, SPIE conference on High-Speed Biomedical Imaging and Spectroscopy: Toward Big Data Instrumentation and Management (2016 – 2018)
7. General Chair and Program Chair, OSA topical meeting on Computational Optical Sensing and Imaging (2018 & 2019)

Dr. Ka Yee Loh:

1. Deputy Secretary-General, International Chinese Practical Writing Research Association (Headquartered in Mainland China and registered in Singapore and Hong Kong SAR) (2018 – Present)
2. Founding Member, International School Chinese Language Education Conference Organizing Committee (Headquartered in Hong Kong SAR) (2016 – Present)
3. External Reviewer, the Teaching Development Grant of the Education University of Hong Kong (2019 – 2022)
4. External Advisor (Teaching Chinese to Non-Chinese Speaking Students), Po Leung Kuk Academy of Professional Education. (2019 – 2022)
5. Association Member, Council of Oxfam. (2018 – 2021)
6. Member, Programme and Advocacy Committee of Oxfam. (2018 – 2021)

Dr. Xiaojuan Ma:

1. Vice president and board member, the International Chinese Association of Computer-Human Interaction (ICACHI)
2. Member, the Information and Interaction Design Committee, China
3. Subcommittee Co-Chair, CHI Conference (2022 & 2023)
4. General Co-Chair, ACM MobileHCI (2022)
5. Virtual Conference Co-Chair, AAAI ICWSM (2022)
6. Senior Program Committee, AAAI Conference (2022)
7. Special Interest Groups (SIGs) Co-Chair, CHI Conference (2021)
8. Associate Program Subcommittee (Area) Chair, CHI Conference (2017, 2018, 2019, 2020, 2021)
9. Associate Program Subcommittee (Area) Chair, CSCW Conference (2021 & 2022)
10. Program committee member, The Web Conference (2020, 2021)
11. Tutorial Co-Chair, ACII (2019)
12. Program committee member, ICHI (2019)
13. Workshop co-organizer, ACM CHI Workshop on Unpacking the Infrastructuring Work of Patients and Caregivers around the World (2019)
14. Special issue co-editor, CCF Transactions on Pervasive Computing and Interaction (2019)
15. Demo Co-Chair, IEEE AIVR (2018)
16. Program committee member, AAAI (2018)
17. Program committee member, IJCAI (2017)
18. Associate Program Chair, DIS Conference (2016 & 2017)
19. Co-organizer, AI in VR/AR Workshop, SIGGRAPH, Asia (2017)
20. Session Chair, CHI (2017, 2018)
21. Technical Co-chair and Video Contest Co-chair, the International Symposium of Chinese CHI (2017)

Professor Huamin Qu:

1. Founding member, IEEE VIS steering committee (VSC)
2. Member, Merit Review Committee, CSE (2020)
3. Member, IEEE VGTC/VPG Best Dissertation Award Committee (2020)
4. Member, Steering Committee of IEEE VAST (2019)
5. Member, University Appointments and Substantiation Committee (2019)
6. Best Paper Committee, IEEE VAST (2019), IEEE PacificVis (2019), IEEE SciVis (2016), EuroVis Short Papers (2016)
7. Member, IEEE VPG Best Dissertation Award Committee (2018)
8. Paper Co-Chair, IEEE VIS'18 (VAST), VIS'15 (SciVis), and VIS'14 (SciVis).
9. Coordinator, AdHoc Research Committee and FYP Committee (2017)

Dr. Sam Chu:

1. Co-Editor, Information and Learning Sciences (2019 – Present)
2. Managing Editor, Journal of Information & Knowledge Management (2015 – 2018)

Dr. Vincent Tam:

1. Associate Editor, the Journal on Ambient Intelligence and Smart Environments (2020 – Present)
2. Executive Board Member (as the New Initiative Chair), the IEEE Technical Committee on Learning Technology (2014 – Present)
3. Advisory Board Member, the International Association for Smart Learning Environments (2015 – Present)
4. Publicity Co-Chairs and Track Program Chairs, the IEEE International Conference on Advanced Learning Technologies (2013 – Present)

Dr. Gary Wong:

1. Associate Editor, IEEE Transactions on Education (2021 – Present)
2. Associate Editor, Frontier in Education (STEM Education) (2021 – Present)
3. Co-Editor, "Teaching Computational Thinking in Primary Education", IGI Global (2017)
4. Member, Global Liaison Committee, ACM Technical Symposium on Computer Science Education (2015 – Present)
5. Chair, Executive Officer Committee, IEEE Hong Kong Section (Education Chapter) (2014 – 2019)
6. General Chair, 2017 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (2017)
7. Member, Assessment Panel on General Studies, Chief Executive's Award for Teaching Excellence (CEATE) (2022/2023)
8. Member, Ad Hoc Committee on Reviewing IT Learning Targets, Education Bureau (EDB) (2022 – Present)
9. Member, Curriculum Development Council Committee on Technology Education (CDCC(TE)), Education Bureau (EDB) (2021 – Present)
10. Member, Working Group on Revamp for Consumer Education for Youth (WGRCEY), Consumer Council (2022 – Present)

Dr. Maggie Zhao:

1. President, International Positive Psychology Association (IPPA) Education Division (2021 – 2023)
2. Institutional member focal point, UNESCO's Network on Education Quality Monitoring in the Asia-Pacific
3. Honorary Advisor, Hong Kong Policy College

4. Member of Research and Development Committee, Hong Kong Examinations and Assessment Authority
5. Associate Editor, *Frontiers in Psychology*: Educational Psychology

Dr. TAN, Cheng Yong:

1. Associate Editor, *Frontiers in Psychology* (2021 – Present)

Dr. Feng, Shihui:

1. Handling Editor, *Scientific Reports* (2021-Present) for the panel “networks and complex systems” under physics panel, published by Springer Nature (<https://www.nature.com/srep/about/editors#networks-complex-systems>)

- 7.4 Any documentary proof of the application of technologies arising directly from this project?

The project team is considering applying to patent the digital literacy assessment. No decision has been made yet.

- 7.5 Other awards and recognitions as a result of this project (please specify):

Faculty Knowledge Exchange Award 2021 for project “Co-creating a new normal of empowered learning through digital citizenship research”.

8. Impacts

- 8.1 What are the current and expected impacts of the project on the long-term development of Hong Kong (social or economic development, e.g. patent, technology transfer, collaboration with external organisations, etc.)?

We believe that the project has made the following impact on the long-term development of Hong Kong:

1. The project conceptualised ***digital citizenship*** as a core competency for students’ learning and well-being in a globally connected world. In light of the guideline issued by the Education Bureau to promote information literacy and e-safety in key learning areas, the theoretical contribution of this project will contribute to the curriculum and pedagogical development of information literacy and e-safety policies for all stakeholders, including schools, teachers, and policy makers in education.
2. The following findings have been widely reported in the media and will have significant long-term impact on educational policy as well as the strategic development directions of many NGOs and charities concerned about education and/or youth development:
 - The importance of digital literacy as a protective factor for cyberwellness and associated mental health as well as an enabling factor for online learning self-efficacy,
 - The association between SES, parenting practices and digital literacy reveal important aspects of digital divide that have not been recognized before.
3. The ***e360 series*** of this project provided a comprehensive picture of students’ learning and socioemotional wellbeing after multiple waves of school suspension and supported different stakeholder communities including policymakers in developing evidence-based action plans that build capacity and resilience to support student learning in the *New Normal*. This set of studies have provided a role model for educational research that are “action-oriented”

in provided actionable recommendations as well as contributing to basic research, advancing our understanding of the complex interactions among factors at different levels of the educational ecosystem.

4. The two artefacts developed as part of the project – ***Digital Literacy Assessment*** (to measure digital literacy) and ***D-City Fighter online game*** (for anti-cyberbullying education and to support learning and assessment of collaborative problem-solving skills) – will help local educational institutions and schools assess their students’ digital literacy and collaborative problem-solving skills. These have the potential to provide schools, teachers, and policy makers with valuable information about students’ key 21st century skills.
-

8.2 Others (please specify):

9. Sustainability of the Project

9.1 Whether there are new ideas evolved directly from this project?

The following are some of the new ideas that evolved from this project:

1. The project team will seek further funding to continue the development of the Digital Literacy Assessment, update the item pool and improve its validity and reliability. For example, AI literacy has gained increasing attention and should be an important component of digital literacy. In the further study, one of our purposes is to update the item pool to assess AI literacy.
2. The project team will extend the age range for the use of the Digital Literacy Assessment to include undergraduate students to enable a broader range of cross-cohort comparisons and to understand the digital literacies of pre-service teachers in local universities.
3. A major charity in Hong Kong has approached the PC to develop an ambitious project that builds on the findings of the present project. The scope of the project includes the development of a comprehensive system of benchmarks targeting different stakeholders in the educational ecology (students, teachers, school leadership practices and infrastructure, parenting practices, etc.), comprising digital competence measures as well as contextual/background variables, that can be adopted on a voluntary basis for understanding the wellbeing and interactions among different elements of the ecosystem. The results will serve as a basis to help schools and teachers evaluate their students’ digital literacy as well as the school’s readiness of promoting students’ digital literacy. The benchmark will also help parents and NGOs to improve their practice of supporting students’ development in the digital world. The charity is also soliciting support from the project team to develop intervention programs to enhance the digital literacy of students and teachers.
4. Digital social capital is one of the research areas pursued by a PhD student and her primary supervisor. A public policy research project is being developed for funding to further understand the role of institutional social capital in fostering and scaling up curriculum and pedagogical innovations.
5. A co-I, Dr Hu, submitted a CRF grant proposal in 2020 and 2021 on using learning analytics and artificial intelligence to improve students' wellbeing. Although the proposal was not approved, the idea can be further explored. Her GRF project explores multimodal learning analytics in understanding learners' cognitive processes with background music. WP4 of the TRS, we also used multimodal learning analytics to understand students' learning lives. The "Smart Planning" workshops, developed by one of her PhD students can also be followed up further to use wearable devices to help students learn time management and self-regulation.

6. A co-PI, Professor Rao, indicated her interest in further exploring digital citizenship development in the early years, in particular, young children's perceptions and understandings of social media.
-

9.2 Whether there are new projects evolved directly from this project?

As reported under section 7.1, the project team has engaged in the following additionally funded projects arising directly from the present project:

1. **Project Title:** Digital Literacy Assessment: a background report for the UNESCO Global Education Monitoring Report 2023. *PI:* Dr Frank Reichert, administered through the Centre for Information Technology in Education. *Funded by* UNESCO (France: USD9,000.00) (04/2022 - 09/2022)
 2. **Project Title:** eCitizen Education 360 - an Action Focused Post-COVID-19 Study for Equitable Quality Education for All. *PI:* Prof Nancy Law. *Advisor:* Prof Catherine Chan. *Co-PI:* Dr Cheng Yong Tan. *Co-Is:* Dr Min Lan, Dr Qianqian Pan. *Funded by* Jockey Club Self-directed Learning in STEM Programme (Hong Kong SAR: HK\$1,037,750.00) (06/2020-12/2020)
 3. **Project Title:** eCitizen Education 360 (2022): An extension of the Learning and Assessment for Digital Citizenship project. *PI:* Dr Cheng Yong Tan. *Co-Is:* Prof Nancy Law, Prof Catherine Chan, Dr Min Lan, Dr Qianqian Pan, Dr Sisi Tao. *Funded by* The D. H. CHEN Foundation (Hong Kong SAR: HK\$1,500,000.00) (06/2022-06-2023)
 4. **Project Title:** Digital citizenship education. *PI:* Dr Frank Reichert. *German collaborator* *Co-PI:* Prof. Dirk Lange, University of Hannover. *Funded by* Germany/Hong Kong Joint Research Scheme, UGC (Hong Kong SAR: HK\$73,500.00) & DAAD (Germany: €13,970.00) (01/2020-12/2021)
 5. **Project Title:** Collective Identification and the Protest Movement in Hong Kong. *PI:* Dr Frank Reichert. *Co-Is:* Dr Wong Pui Shan Mona, Prof Fu King Wa, Prof Nancy Law. *Funded by* Public Policy Research (PPR) Funding Scheme (Hong Kong SAR: HK\$466,867.00) (04/2020-11/2020)
 6. **Project Title:** Students' Assessments of Credibility in Online Environments: Assessment Criteria, Influencing Factors, and Skills for Citizenship in the Digital Age. *PI:* Dr Frank Reichert. *Co-PI:* Dr. Monika Oberle, Georg-August-University of Göttingen. *Funded by* Germany/Hong Kong Joint Research Scheme, UGC (Hong Kong SAR: HK\$89,500.00) & DAAD (01/2023-12/2024)
 7. **Project Title:** A Pilot Trial for the Evaluation of a Coding Program to Improve Digital Literacy of Primary School Students from Low Socioeconomic Background in Hong Kong: An Extension of the Learning and Assessment for Digital Citizenship Project. *PI:* Prof Nancy Law. *Co-I:* Dr Sisi Tao. *Funded by* Boys and Girls Clubs Association (Hong Kong SAR: HK\$8,500.00) (10/2022-03/2023)
 8. **Project Title:** Validation and Implementation of a Performance-based Assessment Tool Measuring Digital Literacy in University Students. *PI:* Dr Sisi Tao. *Co-Is:* Prof Nancy Law, Dr Qianru Liang, Dr Qianqian Pan. *Funded by* HKU Faculty of Education Faculty Research Fund 42nd Round (2022-23) (Hong Kong SAR: HK\$60,000.00) (12/2022-08/2023)
 9. **Project Title:** Assessing and comparing students' digital literacy skills before and during COVID-19: A longitudinal cognitive diagnosis model analysis. *PI:* Dr Qianru Liang. *Co-Is:* Prof Nancy Law, Prof Jimmy de la Torre, Dr Qianqian Pan, Dr Sisi Tao, Mr Zechu Feng. *Funded by* HKU Faculty of Education Faculty Research Fund 42nd Round (2022-23) (Hong Kong SAR: HK\$60,000.00) (12/2022-08/2023).
-

9.3 Whether there are new collaborations developed directly from this project?

The project has established new collaborations:

1. The project team collaborated with **Boys and Girls Clubs Association** to use Digital Literacy Assessment for measuring the effectiveness of coding program to improve digital literacy of primary school students from low socioeconomic background in Hong Kong.
2. The project team collaborated with **Hong Kong Playground Association** that designed an anti-cyberbullying online course for students from local schools.
3. In light of the outbreak of COVID-19 and initial findings of our project, **Jockey Club Self-directed learning in STEM Programme** supported the eCitizen Education 360 project to understand the impact of COVID-19 on schools and students.
4. **The D.H. Chen Foundation** supported the eCitizen Education 360 (2022) project to understand the impact of New Normal on schools and students.

9.4 Please give details on how much money and from which sources has been obtained/requested for the specific purpose of continuing the work started under this project.

As listed above, the project team has received a total of around HK\$3.8M from the government, university, foreign donors, charities, and local NGOs to continue the work started under this project.

10. Statistics on Research Outputs

(Please ensure the statistics in this section are consistent with the information presented in other sections of this report.)

	Peer-reviewed journal publications	Conference papers	Scholarly, books, monographs and chapters	Patents awarded	Other research outputs (please specify)	
No. of outputs arising directly from this research project	24	55	4	0	Type	No.

11. Public Access of Completion Report

(PCs of projects funded in 2010/11 academic year or onwards are required to release the completion reports to the public through the RGC website. Completion reports containing information such as abstracts in non-technical terms, objectives, research output including the list of conference papers / publications / journals and research findings and contact information of PCs should be open to public access.)

Please specify the information, if any, that cannot be provided for public access and give the reasons.

Not applicable.

Information that cannot be provided for public access	Reasons

12. The Layman's Summary

(describe in layman's language the abstracts and research impact of the project.)

The grand challenge for this project was to understand and improve the development of digital citizenship as a multifaceted human capacity from childhood to early adulthood. The project investigated two core competences, digital literacy (DL) and collaborative problem solving (CPS), that are crucial for citizens to exercise their rights and responsibilities in a world where the digital and physical actions, interactions, and interconnections are inextricably integrated.

There are two cross-cutting themes throughout the project and its components: understanding and supporting the wellbeing and development of children and youth as digital citizens. At the core of the project is a longitudinal panel study involving 3 age cohorts (7-10, 11-14, 15-18); the main data collection was conducted in the second half of the 2018-19 and 2020-21 academic years. Assessment of key 21st century skills, including DL and CPS and a survey on students' digital technology use patterns, self-reported wellbeing, personal, family and school background are included in the longitudinal study.

Additional project components include: (1) using mobile and wearable devices to investigate students' learning lives within and outside of the school; (2) developing and using online role play games to support learning and assessment of collaborative problem solving; (3) developing and evaluating advanced AR/VR technologies to enhance online learning interactions, including socioemotional communications/interactions and virtual experiments; (4) using online survey to understand undergraduate students' citizenship participation both online and off-line.

The key research outcomes from this project include: (1) an in-depth articulation the different conceptualizations of digital citizenship with the extant literature on citizenship and citizenship education; (2) a comprehensive understanding of the nature of digital competence and conditions (personal, family, and school) for its development; (3) civic participation by young adults was not differentiated by the mode (on- or off- line) of participation but rather by the nature of the activity. Online and offline participation reinforces each other; (4) digital competence is a protective factor against negative online experiences, contributing towards digital wellbeing; (5) school leadership that fosters a culture of trust, collaboration, and openness to innovation with a broad-based school e-learning team is crucial for online learning preparedness and resilience.

Important additional outcomes from the project include a suite of robust assessment instruments and innovative research methodologies for researching digital citizenship, and advanced learning technologies and programs for the learning and assessment of digital citizens.

The project will have the following impacts on the long-term development of Hong Kong society in terms of digital citizenship education: (1) the project conceptualised digital citizenship as a core competency for students' learning and well-being in a globally connected world. In light of the guideline issued by the Education Bureau to promote information literacy in key learning areas, the theoretical contribution of this project will contribute to the curriculum and pedagogical development of information literacy and e-safety policies for all stakeholders, including schools, teachers, and policy makers in education; (2) the Digital Literacy Assessment Instrument (to measure digital literacy) and the D-City Fighter collaborative online game (for anti-cyberbullying education and to support learning and assessment of collaborative problem-solving skills) – will help local educational institutions and schools assess their students' digital literacy and collaborative problem-solving skills. The deliverables from this project has the potential in the long term to provide schools, teachers and policy makers with valuable information about students' mastery and development of key 21st century skills; (3) the e360 series of this project provided a comprehensive picture of students' learning and socioemotional wellbeing after multiple waves of school suspension and supported different stakeholder communities including policymakers in developing evidence-based action plans that build capacity and resilience to support student learning in the New Normal. In the future, the project team will keep organizing knowledge transfer activities to disseminate the research outputs to the local and international community.