Institution: The Open University		
Unit of Assessment: B11 Computer Science and Informatics		
Title of case study: Empowering people to find solutions to complex challenges through Collective Intelligence		
Period when the underpinning research was undertaken: 2010-2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	**Role(s) (e.g. job title):**	**Period(s) employed by submitting HEI:**
Dr Anna De Liddo	Senior Research Fellow	2008-present
Period when the claimed impact occurred: 2014-2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact

De Liddo's research on the theories and methods required to harvest the Collective Intelligence (CI) of large numbers of people has developed new technologies which public sector organisations, educators, broadcasters and NGOs have used to engage people to participate in decision-making. Through these tools, **De Liddo's** work has:

- Equipped more than 800 UK Health Visitors with a tool to enhance their professional practice;
- Enabled more than 1,300 school and university teachers in Brazil to engage in online collaborative learning;
- Promoted citizen engagement with political election debates in the 2015, 2017 and 2019 UK General Elections;
- Supported peace building education in Rwanda after the 1994's genocide.

2. Underpinning research

De Liddo's research explores the socio-technical theories, methods and tools required to harvest the Collective Intelligence (CI) of large numbers of globally distributed people to work together to solve complex societal challenges. Her work creates intuitive, easy to use tools which engage people in useful, unbiased, and democratic conversations that lead to intelligent group behaviours and actions to address critical issues, such as climate change, democratic and health crises. These technologies also produce a wealth of structured data on which De Liddo conducts advanced computational and visual analyses of sensemaking, the process by which people make sense of their collective experience.

In a 2012 article **[O1]**, **De Liddo** argued that a new type of collective intelligence was necessary to help people collectively to make sense of and co-create innovative solutions to complex societal challenges, to which there is no single correct answer. This Contested Collective Intelligence (CCI) approach enables large scale deliberation between distributed users. It applies advanced computational methods, such as Natural Language Processing and argumentation mining, to structure and analyse online written dialogue between individuals and identify both stated and unstated points of agreement. It creates opportunities for collective sensemaking by enabling people to visualise and reflect on each other's ideas and arguments.

De Liddo applied the approach to a prototype visual tool, named Cohere, which allowed users to create, mark-up, connect and share ideas online. Her 2014 publication **[O2]** evidenced that i) showing people a visualisation of their online dialogue and ii) structuring their interactions through the social process of argumentation, which encourages people to reach conclusions through logical reasoning, could successfully support large scale decision-making.

In a subsequent article **[O3]**, **De Liddo** further defined this novel research agenda on deliberation technologies in the field of collective intelligence, establishing a critical set of research challenges, such as "*summarising the state and content of deliberation to promote engagement and deepen understanding; generating collective creative solutions; and translating proposals into commitments to action*".

Between 2013 and 2015, **De Liddo** led a European Commission-funded GBP2.25 million CATALYST research programme and a health innovation project funded by the Burdett Trust for Nursing (200K) to apply her CCI approach to develop and test three new tools. The first, The Evidence Hub, built on Cohere's argumentation data model to enable online communities of practice to gather and debate ideas and solutions to specific community issues. The second tool, LiteMap, used collaborative knowledge mapping, web annotation and argumentation technology to enable users to visualise debates online. The tool provides crucial support to brainstorming, creative ideation and idea structuring. Finally, DebateHub directly facilitates group decision-making by supporting online campaigns. Through these, users collectively propose, debate and select new ideas to tackle open challenges.

De Liddo continued this research theme during the 2013 to 2016 EPSRC-funded Election Debate (EDV) Visualisation project. The GBP284,000 programme examined how CCI technologies could improve citizen engagement and sensemaking during political elections. EDV produced a novel technology for advanced video replays of televised UK election debates, named Democratic Replay. It also created a new method and interactive tool to harness audience feedback on live political debates at scale, called Democratic Reflection. This interactive web app consists of a grid of coloured flashcards. Each represents a short statement the viewer would like to express during debates, such as "*This is a strong argument*", or "*This is getting interesting, I love this!*", or "*Even if what he says is true I do not trust him*". Democratic Reflection records, aggregates and automatically analyses users' feedback to produce personal learning analytics that they can explore at the end of the debate. Research findings from live and lab tests demonstrated these civic technologies' value in supporting citizens in the complex sensemaking process of political choice. Crucially, they indicate that innovative discourse-based CI tools are effective instruments to promote critical thinking and shift political opinion **[O4, O5, O6]**.

3. References to the research

O1. **De Liddo**, A., Sándor, Á., and Buckingham Shum, S. (2012) Contested Collective Intelligence: Rationale, Technologies, and a Human-Machine Annotation Study. *Computer Supported Cooperative Work* Journal. *CSCW.* 21(4-5), pp.417–448. https://doi.org/10.1007/s10606-011-9155-x

O2. Iandoli, L., Quinto, I., **De Liddo, A**., and Buckingham Shum, S. (2014) Socially augmented argumentation tools: Rationale, design and evaluation of a debate dashboard. *International Journal of Human-Computer Studies*, 72(3), pp.298-319. https://doi.org/10.1016/j.ijhcs.2013.08.006

O3. Convertino, G., Westerski, A., **De Liddo, A**., and Díaz, P. (2015) Large-Scale Ideation & Deliberation: Tools and Studies in Organizations. Journal of Social Media for Organizations, 2(1), pp.1-4. http://www2.mitre.org/public/jsmo/pdfs/02-01-lrg-scale-ideation.pdf

O4. Plüss, B., and **De Liddo, A**. (2018) Democratic Replay: Enhancing TV Election Debates with Interactive Visualisations. In Proceedings of the 51st Hawaii International Conference on System Sciences. http://doi.org/10.24251/HICSS.2018.215. Best Paper Award Nomination.

O5. **De Liddo, A**., Plüss, B., and Ardito, A. (2020) Democratic Reflection: Nudging Citizens' Democratic Engagement with Political Election Debates. In: Companion Publication of the 2020 Conference on Computer Supported Cooperative Work and Social Computing (CSCW2020), ACM. https://doi.org/10.1145/3406865.3418562

O6. **De Liddo, A**., Souto, N.P., and Plüss, B. (2021) Let's Replay the Political Debate: Hypervideo Technology for Visual Sensemaking of Televised Election Debates. *International Journal of Human-Computer Studies*, vol. 145. Available online 27th August 2020. https://doi.org/10.1016/j.ijhcs.2020.102537

4. Details of the impact

Equipping UK's Health Visitors with a tool to collectively enhance their professional practice

In 2014, the UK's professional body for health visitors, the Institute of Health Visiting (iHV) adopted The Evidence Hub, based on **De Liddo's** research **[O1-O3]**, to create its e-Community of Practice Evidence Hub (HVeCOP). The platform allows health visitors to raise issues, access a wide variety of resources and discuss practices to improve the children and families' health. Approximately 776 of the specially-trained UK nurses and midwives who support young children and their families have since used the tool to systematically capture and harness evidence of good practice **[C1**, p.3**]**. This community has also used the Evidence Hub to discuss 137 issues, propose 76 changes to health visiting practice, share 379 resources and foster a network of 39 organisations **[C1**, pp.5-9**]**. Writing about the technology on the iHV's website, health visitors have described the hub as "*a fantastic resource",* which provides *"support through a robust and substantive network headed by a small team of Champions from the Institute"* **[C1**, p.10**]**.

In a January 2021 letter, a prominent iHV Fellow explained how "*the EH platform enables a process of evidence-building to be followed, from posing a question or problem, to discussing the question, providing resources, case examples and sharing scientific papers*". This, they explain, allows the classification of evidence "*into topic areas that were instantly relevant to health visitors*" **[C1**, pp.2-3**]**. The iHV fellow also describes how health visitors could use the software "during an encounter with parents if a question came up that needed shared decision making", and how it allows them "*to record their interventions on the platform as CPD [Continuous Professional Development]*". It also creates "*a mechanism for archiving evidence that could be used to influence policy as well as practice*" **[C1**, p.3**]**. They believe the Evidence Hub "*has addressed issues of health care and health visiting practice that, in tandem with research and policy development, have led to more open dialogue with service users (Parents) and an opportunity to present evidence to public health commissioners*" **[C1**, p.4**]**.

An independent evaluation of the tool **[C2]** suggests that the hub is also a useful resource that complements agile and paperless working. A health visitor and Evidence Hub user, reflecting on the mobile nature of her working practice, notes that they "*have now been issued tablets as part of our agile and paperless working future […]. In my future practice in my car or in Tesco as a mobile worker I will no longer have that luxury [of knowing where my team members are]. Yes, I could phone my colleagues, but I won't know if they are with a family, on the phone or driving. The evidence hub will be able to fill that void and become my first resource*" **[C2**, p.438**]**.

Enabling online collaborative learning in Brazil

In 2015, the Brazilian open research community, COLEARN, translated **De Liddo's** LiteMap technology into Portuguese. It drew on her research **[O1-O3]** to build an online network to enable approximately 1,346 schoolteachers and researchers from 5 universities and 319 local schools across Brazil to collaborate and coordinate online course activities **[C3**, pp.7-8**]**. Using LiteMap, the community advanced many projects, such as encouraging 1,473 learners to coordinate with 36 research educators to develop collaborative knowledge maps about genetically modified foods **[C4**, p.42**]**. It also used the LiteMap tool for undergraduate-led inquiry and professional development of teaching staff. In feedback collected during a European project with the same community, called ENGAGE, teachers acknowledged "*the discussion supported by technologies increased students' participation*". They also noted that the "*tasks introduced helped students generate more questions and arguments, resulting in very reflective interaction in the classroom*" **[C4**, p.43**]**. A comprehensive review of the ENGAGE project demonstrated that **De Liddo's** LiteMap technology improved collaborative online learning experiences by enabling the systematic gathering, mapping and visualisation of individual students' contributions to various online dialogues **[C3]**. For instance, students used LiteMap to share questions, ideas, arguments, counterarguments, data and facts, to systematise their evidence-based opinions about reducing the Zika virus. Litemap also increased students' awareness of both Zika's spread

and the importance of fostering scientific literacy **[C3**, p.11**]**. The review shows that LiteMap was successfully used alongside mainstream social media tools such as WhatsApp, Facebook, Twitter, and Hangout, to promote Responsible Research and Innovation (RRI) through open education, and fostered the second largest community of RRI adopters in Brazil, after Facebook **[C3**, table 2, p.8**]**.

Promoting citizen engagement in political election debates in the UK

One of the UK's leading broadcasters, ITV, trialled the Democratic Reflection tool **[O4, O5]** with a representative panel of 242 UK voters, during its 2nd April 2015 televised debate between all seven UK political party leaders, ahead of that year's 7th May general election **[C5]**. In feedback collected during the trial, these panel members either agreed or strongly agreed that the tool made them "*really focus on the debate*" (79.8%) **[C6**, p.13**]**. Crucially, 56% also agreed that the experience with Democratic Reflection defined how "*they would like to be involved in political election debates in the future*" **[C6**, p.17**]**. ITV repeated the exercise during leaders debates before the June 2017 and December 2019 UK general elections **[C7]**. Citizens who used the technology during the 2017 elections said that the platform's personal analytics altered how they looked at specific political leaders: "*I came into this group more or less decided on what I was going to vote for, but the statistics completely changed my mind, so that helped"; "When I came in I was a conservative. But my analytics showed Jeremy Corbyn on top, I was so surprised!"; "To someone who's really undecided on who to vote for, it is quite interesting to see what my reactions were […] I was a bit like oh, right. Okay, so obviously I agree with what they're saying. Maybe I need to go back and look at their manifesto and read it all through again"* **[C8]**. Meanwhile, approximately 70% of the 69-strong undecided UK voters who took part in 2019 agreed that Democratic Reflection "*helped them reflect on the debate in a deeper way*" and 65% agreed that watching the debate with the tool "*changed some initial assumptions they had before the debate*" **[C6**, pp.31-32**]**.

Supporting peace education in Rwanda

In March 2019, UK-based NGO, The Aegis Trust, which works on the prevention of genocide and mass atrocities worldwide, used the Democratic Reflection tool **[O4, O5]** to engage a community of 50 teachers and young people. Part of the Isôoko project, which uses digital technologies to support peace education, the initiative encouraged participants to actively listen and reflect on a video, called "Ubumuntu", which tells a range of stories that relate to the 1994 Tutsi genocide in Rwanda. Democratic Reflection helped users connect to the accounts personally and challenge their prior assumptions **[C9**, p.2**]**.

In a December 2019 interview with **De Liddo**, the Aegis Trust Digital Resources and Comms Manager for Rwanda explained how Democratic Reflection gave the trust "*the power of knowing what's going on in the people they train*" **[C10**, p. 4, line 1**]**. They describe it as a tool to "*increase value in terms of engagement*" with peace building efforts, which "*gives content producers the possibility of learning from people who are actually using their content"* **[C10**, p.2, last paragraph; p.3, line 9**]**. Speaking of the tool's role in peace education, they noted "*you can only achieve [peace education] if individually people are connected, and people are really reflecting on their role in society. That is something Democratic Reflection […] was really promoting"* **[C10**, p.5, line 11**]**. They also reported very positive feedback from both parents and young people. Young people in particular recognized the tool's capability to promote reflection and capture emotional reactions **[C10**, p. 4, last paragraph; p.5, second paragraph**]**.

5. Sources to corroborate the impact

C1. Evidence of impact on enhancing health visitors' professional practice

- Letter from Senior Leader at the Institute for Health Visiting and Professor of Community Nursing and Public Health, Centre for Health Services Studies, University of Kent, which i) evidences how **De Liddo's** research influenced their decision to adopt The Evidence Hub; ii) provides key data on users' engagement with the tool and quotes from user

feedback (collected from the platform); and iii) emphasises how the platform has changed the professional practices of the health visitors [pp. 2-4].
- Extracts from the Evidence Hub Website evidencing user engagement and data produced and shared by the Health Visiting Community [pp. 5-9].
- Testimonials from the iHV Institute of Health Visiting Practitioner and iHV Fellow [p.10].

C2. Ikioda, F., Kendall, S., Brooks, F. and Reidy, C., 2014. Developing an online community of practice to empower health visitors: Findings from a pilot study. *Journal of Health Visiting*, 2(8), pp.436-440. https://doi-org.libezproxy.open.ac.uk/10.12968/johv.2014.2.8.436

C3. Okada, A. and Sherborne, T., 2018. Equipping the Next Generation for Responsible Research and Innovation with Open Educational Resources, Open Courses, Open Communities and Open Schooling: An Impact Case Study in Brazil. *Journal of Interactive Media in Education*, 2018(1), Art. 18, p.7-8. https://doi.org/10.5334/jime.482 (*See Table 1, Public Engagement Raw; and LiteMap raw in Table 2*).

C4. Okada, Alexandra (2016) "Innovative Teaching for Responsible Citizenship - Policy Report". ISBN: 978-14-7302-064-1 PAGES: 50. Last Accessed on Jan 5th 2020. Available at: http://oro.open.ac.uk/46455/

C3 and C4's author, Dr Okada, is a researcher at the OU. However, she was not involved in the development of LiteMap. These independent papers describe her experience as LiteMap user and intermediary to evaluate the tool's impact on communities in Brazil.

C5. "Making the UK's political debates more responsive to public need": A full-length press release on Democratic Reflection published by Civic Hall. Available at: https://civichall.org/civicist/political-debates-more-responsive-public-needs/

C6. Evidence of participant engagement with Democratic Reflection. This includes feedback/results from the 2015 and 2019 Elections panels.

C7. ITV coverage of the Democratic Reflection panel in Leeds: "ITV News Correspondent John Ray reports as Leeds University lined up a group of 100 undecided voters to watch the debate and monitored their responses using technology developed by **Dr Anna De Liddo**". Link: https://www.itv.com/news/2019-11-19/itv-debate-boris-johnson-and-jeremy-corbyn-go-head-to-head News Political Correspondent Libby Weiner.

C8. Testimonials from Focus Groups carried out during the 2017 UK Election Trial. Timestamps: 19:51; 18:52; 18:15.

C9. Grunewald P, Baar T. 2019. ISOOKO H2020 EU project website: "Training active listening by using digital technologies". Available at: https://bit.ly/2CYkw12

C10. Transcript of interview with Aegis Trust Digital Resources and Comms Manager for Rwanda [Dec 2019].