Impact Evaluation for eLearning in Science and Health Literacies: outline Concept and Workplan

Overall objective and target audiences

The **overall objective** of the proposed study is to provide evidence of the comparative impacts of using e-learning methods to promote science literacies internationally in a post-COVID situation. The **target audiences** for its results are decision-makers and other stakeholders considering the case for investment in e-learning, including educators, science communicators, health professionals, policy-makers, service providers, parents and the general public, globally.

Background and concept

Distance education is the fastest-growing mode of teaching, training and learning across all levels of education in both formal and non-formal settings. Its many variants include e-learning, mobile learning and immersive learning environments. The summary report of the extensive study carried out by the Network for Information and Digital Access NIDA between 2017 and-2020 (*The impact of Science Literacy delivery methods - what works?*) and its companion publication (*Outline model Impact Evaluation toolkit*), both released in October 2020, draw attention to the potential and widely demonstrated advantages of e-learning within science and health literacy, especially in terms of access in a diversity of settings. These can include personalisation, content updating, repeatability, lower costs and student control of pacing.

Online learning allows ideas to be presented in a variety of ways using multimedia components, such as webinars, mobile learning, MOOCs and digital badges, for synchronous or asynchronous delivery and adaptable within blended/hybrid learning contexts. There is substantial evidence that e-learning can improve access to education for people from various backgrounds and situations by offering an alternative method, although Its effectiveness varies from context to context and has also been shown to make considerable demands on users' motivation and digital literacy as well as on the institutions involved.

Several studies on the general effectiveness of e-learning in degree programmes have been carried out over the last two decades, demonstrating the worthiness of plans and matrices for impact assessments (IA) to address aspects such as course or programme objectives, relationship to institutional and accreditation expectations, student learning outcomes and performance criteria, implementation strategies and evaluation methods. Examples exist of approaches to health impact assessment (HIA) and increasing numbers of medical education and Continuous Professional Development CPD) programmes have adopted e-learning approaches. There remains a need for wider evaluation of the effectiveness of e-learning in healthcare as part of ongoing quality improvement efforts.

Some findings have demonstrated that student achievement in remote settings via distance learning is often equal to that found in traditional education environments, across all learning outcome categories (knowledge and understanding, inquiry skills, practical skills, perception, analytical skills, and social and scientific communication). Studies, for example, of nursing training have found little statistical difference between groups exposed to e-learning and traditional learning methods.

On the downside, potential disadvantages include possible technical problems, costs related to technology and in the development of programmes, limited direct interaction, lack of exchanges and relations with other learners, absence of the physical presence of the teacher, decrease in motivation to learn, need for greater self-discipline, attenuation of the desire to compete with other learners, limitations on participation

and higher dropout rates because of poor access, language barriers and lack of computer and Internet literacy. e-Learning may pose problems for students' academic integrity and can magnify the digital divide. The nature of the Internet provides few global safeguards for reliability of material or the protection of data against misuse.

Numerous questions remain to be addressed about the extent to which the well-managed adoption of digital technologies can lead to beneficial transformations in knowledge, attitudes, and behaviour. Much also remains to be achieved in understanding the profound effects (both positive and negative) of social media, mobile apps and web-based services in this field, despite the clearly demonstrated impact on increasing the ease and volume of communication. Increased levels of anxiety when using computers and the lack of ICT skills, unreliable computer systems and the absence of technical support may also impact the learning progress of students. Educators might need to improve their own ICT skill base and need extra support and incentives to adopt e- learning teaching strategies.

The relevance of all these factors has been intensified during the COVID pandemic, which began after the completion of the NIDA research, and which necessitates distance learning modalities and hastened their uptake. Some technical tools, such as Zoom, have emerged as essential for online communication in learning contexts. The effects, together with the extent and scope of their retention and further development in a post-COVID education world, are likely to be an issue of wide concern. Stronger evidence of their impact in comparison with face-to-face models will be needed by decision makers and educators in the longer term to underpin investments in education.

The need for further evidence of comparative impact of e-learning methods appears to be a priority for science and health communication literacies at present. A recommendation emerging from the NIDA summary report is that they should be pursued more systematically and at increased scale. In general, this applies here as much as, if not more than, in any other domain, in a world where the need for rational public understanding of the scientific background to vital global issues such as pandemics, climate change and biodiversity looms ever larger, not least in view of fake and/or mis-information on social media.

A great deal of informative impact evaluation in Science Literacy has been carried out in relatively small-scale settings. Nevertheless, it is noteworthy that quite often this can lead to demands for bigger ‘proofs’ and more widely relevant evidence, especially in a digital context. Proposals for methodological improvement to impact assessment frequently relate to requirements for increasing the time frame of results, directness and use of data in measurement, experimental designs, bigger and more random samples and triangulation of methods. These would increase validity and provide better quantification of different types of learning. Matching materials with narratives may, in addition, help determine specific literacies to specific audiences, while relying on different cognitive mechanisms.

Sufficient data, breadth of focus and improved methodologies are needed to make impact assessment of e-learning in science and health literacy relevant and effective, accompanied by robust quantitative instruments to measure the impact on outcomes for and perceptions of both learners and educators, involving research that goes beyond the ‘does it work’ question and asks what critical features influence its effectiveness. A focus is needed on practical models that educators can use to realize the full potential of e-learning, less on the long list of ever-evolving technologies and more an understanding of these technologies from an educational perspective.

Proposed workplan

Phase 1 – Consensus building and definition

Task 1.1 Appoint an expert **Coordinating Committee** to oversee the work of the project.

Task 1.2 Organise a series of international online **expert workshops** for each educational sector, constructed to enable an iterative process aimed at defining: (a) shared objectives, (b) outcomes/indicators and (c) toolsets/methods.

Task 1.3 Identify a **facilitator** familiar with impact evaluation issues in each sector to lead the events.

Task 1.4 Record and summarise the events, enabling a period of reflection, further **feedback and online discussion** designed to address outstanding points.

Task 1.5 Create a series of **toolsets and reporting frameworks** adaptable for use in each of the sectors.

Phase 2 – Methodology and toolset trials

Task 2.1 Identify at least two **organisational settings to host trials** in each sector (perhaps up to ten impact assessments (IA) in all).

Task 2.2 Specify the precise **goals, data collection and analysis methods** of each impact assessment trial, optimising comparability of the outcomes of delivering sets of curriculum or literacy objectives through face-to-face and e-learning approaches.

Task 2.3 **implement the impact assessments** (6 months duration) in the sectoral 'clusters', making provision for support of longitudinal studies in the period following the trials (up to 1 year).

Task 2.4 **Aggregate and analyse** the data generated locally by the trials, according to best practice principles.

Phase 3 – Dissemination and roll out

Task 3.1 Develop and implement a **dissemination plan** to reach the main stakeholder communities and networks identified in each sector, primarily using online channels, targeted social media, physical and online events etc.

Task 3.2 **Evaluate the results** of the trials, produce visual presentations, and create compelling narratives based on the data analysis.

Task 3.3 Publish a **report** summarising the lessons learned in each sectoral cluster.

Task 3.4 Instigate a stakeholder-led process of further adaptation of the IA methods and toolsets as a series of **online packages** for wider use.

Task 3.5 Make the project results widely available for **re-use under open licence.**

Task 3.6 Set up or identify a channel for sustainable **cloud-based hosting** and development of the toolsets, alongside data analyses obtained from subsequent implementations.

Task 3.7 Seek support from major **international organisations** working in the field of science and health literacy in order to develop upscaling and international comparisons.