Mobilising Knowledge through Global Partnerships to Support Research-informed Teaching: Five Models for Translational Research

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ABSTRACT

Improving the quality of teaching is of major global concern: UNESCO's Sustainable Development Goal (SDG) 4c in the Education 2030: Framework for Action (UNESCO, 2015) calls for high quality teaching for all students – in developed and developing countries; the OECD has on a number of occasions, challenged the education system to improve Knowledge Management (OECD, 2003, 2007, 2009, 2010).
This article builds on the 2015 JET special issue on *Translational Research and Knowledge Mobilisation in Teacher Education* which explored the concept of 'translational' or 'theory to practice' research, a concept new to the education sector but well-established in medicine and funded by major funders. Many of the articles came from members of an international network, the MESH network, which was formed in 2012 by teacher educators and their professional associations to explore solutions to longstanding UNESCO and OECD challenges to educators and members have been undertaking research and development to define further the concept and practice of translational research (TR). This article introduces five TR models which have been identified from developmental work with organisations in different countries: South Africa, Bangladesh, UK, Australia, Pakistan. Distinct TR models have emerged from regional networks (university staff and teachers), professional subject associations, specialist research units, an international NGO working in crisis settings (needing a rapid response), and from investigations into the release of knowledge from PhD theses.

While the models are distinct, they share common features which form the emerging MESH Translational Research methodology introduced in this article.

Inputs to the models are similar: high quality research reports, already validated and need from stakeholders.

*Process*es vary depending on the context.

Outputs however are similar: translational research publications i.e. research summaries linked with implications for practice which the MESH network have called MESHGuides (www.meshguides.org). These TR publications complement existing forms of publication. A TR repository is part of the MESH knowledge mobilisation strategy to give teachers quick access to summaries of the latest knowledge. Contextualisation and translation to other languages are built into the publication processes which include updating and refinement of guides so as to accumulate knowledge.

Our analysis following the holding of international summits (EFC, 2016; 2017) to identify solutions to the OECD and UNESCO challenges is that international coordination is needed to scale up and further test existing successful practices for mobilising and translating research knowledge and to provide access to all. This article proposes the MESH TR methodology as one affordable practical and scalable solution to the

OECD and UNESCO challenges of keeping teachers up to date and of making new knowledge accessible to teachers regardless of their locations.

keywords: communal constructivism, innovative methodology, knowledge management, knowledge mobilisation, translational research, research-informed, evidence-based, UNESCO, OECD, SDG

INTRODUCTION

'*The limits of my language* mean the limits of my world.' (Wittgenstein, 1922, p.149, 5.6)

Wittgenstein's observations explain one of the major problems we, and others, suggest the education sector faces in achieving research-informed teaching: the lack of shared language and shared understanding of key concepts around: pedagogy (Simon, 1981; Livingstone et al, 2017), forms of knowledge for teaching (Shulman, 1987) and research, including translational research i.e. research that bridges the theory to practice divide. This article's contribution to developing a shared language and shared understanding of new concepts is to describe and analyse five models for 'translational' research, in order to identify the core features of translational research as it applies to the education sector.

We also make the case for the potential for a systematic approach to translational research to address improvement challenges to the education sector identified by the OECD and UNESCO. Almost twenty years ago, the Organization for Economic Co-Operation and Development (OECD) stated that the "rate, quality and success in knowledge creation, mediation and application are relatively low in the education sector compared with other sectors" (2000, p. 103). Since then, regular reports from international organisations such as UNESCO (2015) and the OECD (2000, 2003, 2009, 2010) have outlined the challenges countries face in meeting the professional development needs of teachers in order to ensure that their teaching is up-to-date and research-informed and thus has the greatest impact on educational outcomes. Despite this longstanding concern, research and analysis continues to indicate that the education sector in many countries lags behind other professional sectors in taking advantage of digital tools to support knowledge management[1,2]; specifically for coherent provision of continuing professional development that can provide teachers with access to the latest research-informed knowledge (Leask and Younie, 2013).

The challenge of translating research evidence into effective practice for teachers is well documented (Leask and Younie 2013, Jones et al., 2015). While teachers are interested in research and value it, they find it difficult to engage with it in their daily work (Procter, 2014). Despite the many excellent case studies that show how educational research has had a significant effect on policy and practice (e.g. BERA, 2013; REF, 2015; AcSS, 2016), impact remains inconsistent. Buchanan (2013) argues the impact of even large investments in social science 'is still a matter of chance' (p.185). This is clearly the case in the education sector where the lack of significant progress in knowledge management is not due to a lack of initiatives (EFC Global Summit Report, 2016).

In other sectors, the calls for the development of 'research-based' practice since the 1990s (Buchanan, 2013) have led to major initiatives such as the National Institute for Clinical Evidence (NICE), Cochrane Collaboration (focusing on healthcare) and the Campbell Collaboration (focused on social interventions). These initiatives are not merely online repositories of research papers, but translate the research into an accessible format. Similarly, we would argue that research-informed teaching requires evidence to be available for developing pedagogic practice for all subject areas, about how to most effectively teach each concept in each curriculum area, for all ages and types of learner.

Goldacre (2013) argued that there was a 'huge prize to be claimed' by the education establishment to create, develop, and use a shared knowledge base to improve the ways teachers use evidence to affect the outcomes of pupils. However, how teaching professionals access and contribute to this knowledge base remains a heavily debated and thorny issue (Hammersley, 1993, 2001, 2002, 2007, 2013; Fagundes, 2016;

Gore and Gitlin, 2004; Hollingsworth, 1992; McLaughlin et al., 2004; McIntyre, 2005; Mincu, 2013; Poultney, 2017; Wiliam, 2002). Developing teaching as a research-informed profession, which is school-led and connects into a self-improving system is complex (Hempenstall, 2006; Leat et al., 2014; Horvath et al., 2017). Arguments are levied against this development on the basis that teachers are not fully-fledged researchers (Hillage et al., 1998; Wiliam, 2015; Stewart, 2015) along with the difficulties practitioners face in finding and using research evidence in an accessible way (Procter, 2014; DfE, 2016:39).
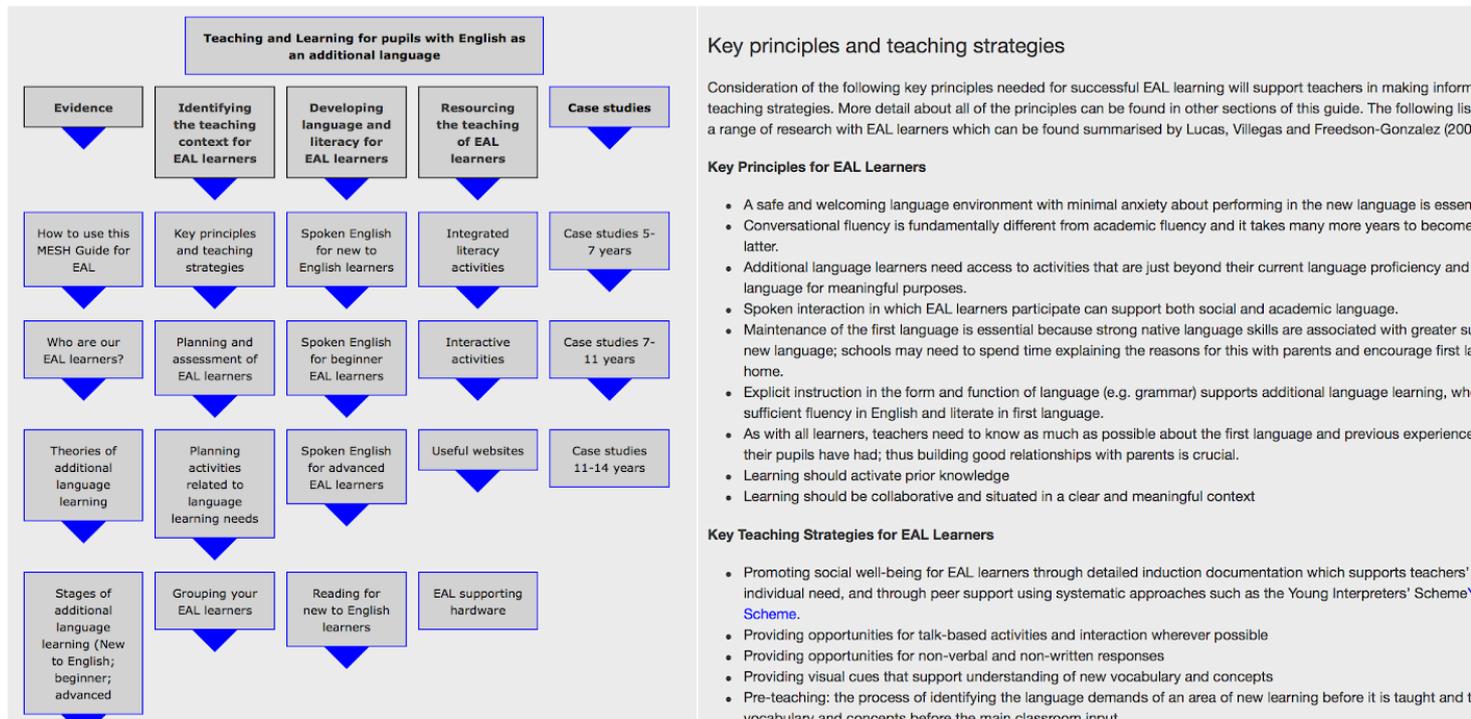
ADDRESSING THE CHALLENGE OF RESEARCH-INFORMED TEACHING

One response to these challenges is the MESH (Mapping Educational Specialist knowHow) system developed by an international group of educators to provide the education sector with an accessible, comprehensive knowledge-base to support research-informed practice in subject teaching in classrooms (Burden, Younie and Leask, 2013). This system builds on the foundations of 20 years of research into forms of teacher research, type of teacher knowledge (MESH, 2018) and the use of digital technologies to support access to research-based knowledge for teachers (see Younie and Leask, 2013, EFC Global Summit Report, 2016).

MESH provides a system for knowledge management (KM) through the communication and dissemination of research for professional practice in the form of 'MESHGuides' (www.meshguides.org, for an example, see Figure 1). MESHGuides summarise educational research that is relevant to teachers' professional practice and present this in the form of graphical flowcharts rather than as prose with research condensed into accessible blocks. While the published MESHGuides provide an accessible format for disseminating professional knowledge, the method through which they are constructed is a 'translational research' strategy that mobilises the knowledge held by researchers and translates this into a form suitable for other professionals. This strategy of creating 'translational research' (TR) is open to all relevant stakeholders in education and utilizes digital tools to address what has to date been an intractable problem - access to research-based pedagogic knowledge. It thus provides a quality-assured, systematic process for creating a bridge between researchers and practitioners.

Figure 1: Example of a MESH Guide (EAL)

EAL

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The creation of the MESHGuides system is a form of 'communal constructivism' (Leask and Younie, 2001), whereby digital tools help to bring international networks of educators together to collaboratively construct new knowledge. The benefits of this digital infrastructure are set out by Jones, Procter and Younie (2015) who note that due to their open online accessibility, by 2015, the guides had been accessed by readers from 134 countries. More recent data demonstrates that the MESHGuides had been accessed from 193 countries by August, 2018. As a result, the guides can be used to provide access to teacher professional knowledge in countries for whom raising the quality of education is a particular challenge and priority, for example, Pakistan (Leask and Jumani, 2015) or to meet the challenges faced by countries with small populations or economies, thus helping to address UNESCO SDG4c, to improve the quality of teaching. In addition, because the guides are online, they can be regularly updated, to keep teachers current with both subject-content and new pedagogical approaches as they develop and new research is made available.

Evidence from initial testing of the guides shows that teachers perceive the use of MESHGuides as having a positive impact on their planning and pupils' learning (Ovenden-Hope and la Velle, 2015). In 2017, an international online questionnaire about the MESH strategy (Procter and Younie, forthcoming) found that 74 per cent of respondents reported that the guides were easy to understand and that 83 per cent would recommend them to colleagues. A challenge for the MESH system is articulated by Jones, Procter and Younie (2015) who noted that practitioners conceptualised the guides as sources of knowledge that they could draw on, but that a cultural shift would be needed before practitioners felt able to contribute research to the guides themselves.

Following the announcement of the UNESCO Sustainable Development Goals in 2015, an EFC (Education Futures Collaboration charity) Global Summit was held in London, to consider how a knowledge management strategy could assist in the achievement of Goal 4c: "Ensure inclusive and quality education

for all and promote lifelong learning" (UNESCO, 2015, p.1). The reports that resulted from the summit (EFC, 2016, 2017) built on earlier work setting out the problems and solutions for knowledge management (KM) in education and concluded that with consistent national and international leadership supported by an administrative infrastructure, professional practice could progress swiftly to become research-informed.

Working in Partnership with Global Stakeholders

While the research discussed above has shown the potential benefits of the MESH system, there are several remaining challenges, particularly managing expansion and scaling up of engagement. The focus of this article is to build on the earlier conceptual work (e.g. Burden, Younie and Jones, 2013) by reporting on experiments since 2015 in developing models for **mobilising the knowledge held through organisations, to produce translational research outputs.**

Here, we present five models that illustrate how the MESH translational research method can be applied in practice. Models, as organising frameworks enable us to understand complex phenomena and to develop multi-faceted processes to represent and deal with those phenomena, in this case the translation of new research knowledge for teaching.

The five models presented here demonstrate that the MESH translational research system provides a dynamic process, specifically using the affordances of technologies for easily updating online publications, to enable the accumulation and updating of research knowledge relevant to teaching. The description of the five models below is followed by a summary of their common features in order to define an emerging model for a MESH Translational Research system.

FIVE TRANSLATIONAL RESEARCH MODELS - Stakeholders and Researchers working in Partnership

The five models illustrate how the MESH translational research method has been applied in practice though partnership with different stakeholders. As Jones, Procter and Younie (2015) have discussed, the MESH approach has always been a participatory model involving the commitment of researchers and practitioners. However, as the five models discussed here show, over time, the MESH approach has been developed to encompass a much broader range of global partnerships. The models are presented chronologically and show how the partnerships developed from collaborative international case studies of experimentation with the MESH TR methodology, working with partners from Bangladesh, Pakistan, Australia, South Africa and the UK. The types of partnerships now include:

· regional/local networks with university, school and local authority staff working together,
· a specialist research institute,
· professional associations,
· an NGO, and; with
· via a national validating group, PhD supervisors and their students.

The first three models are well developed and the MESHGuides produced through these models have been evaluated. While the first MESHGuides to arise from Models four and five have been published, these models continue to be developed and evaluated. In particular, Model 5 is of a different type because it outlines an emerging national model for mobilising knowledge commonly left hidden in doctoral theses. We suggest that doctoral theses are, for the education sector, a largely untapped source of knowledge coming as it usually does from individual's particular interests rather than organisational remits. All of the MESHGuides listed can be found on www.meshguides.org.

Model 1: Collaborations within a region: local authorities, universities and teachers
The first MESHGuides to be produced were the outcome of collaboration between university academics and practitioners. The MESHGuides for Spelling (Harrison *et al.*, 2014), Clinically Based Teaching (Flynn *et al.*, 2015, McLean Davies *et al.*, 2015) and English as an additional Language (Flynn *et al.*, 2015) are

examples of sustained collaborative work between teachers, local authority colleagues and university researchers. This combination is particularly helpful because as Flynn *et al*. (2015) point out in the context of the English as an Additional Language MESHGuide: "the MESHGuide will potentially serve teachers effectively, because it was written as a collaborative act between practising teachers, specialist teacher advisors for the teaching of EAL and an academic with a research interest in the teaching and learning of EAL." (p.17).

In this model, university academics identified aspects of research knowledge that had not been effectively disseminated to practitioners. They then worked with practitioners and local authority experts to translate the research in to a more appropriate form and to evaluate this. Sponsorship was provided by universities and an anonymous donor.

Model 2: Collaboration with a national professional subject association
Professional subject associations are independent membership organisations with expertise in specific curriculum subjects. Members of these associations are experts in their field and have an interest in how their subject is taught in schools and other educational settings. This model developed from an experiment to see if and how subject associations can adopt the MESH system in order to disseminate their professional knowledge to schoolteachers. While in Model 1, the university researchers, teachers and local authority colleagues in their network identified research knowledge to disseminate more effectively, in this model, the subject associations identified the need and then commissioned academics and other experts to summarise and mobilise this knowledge.

For example, the Association for IT in Teacher Education (www.itte.org but now the Technology, Pedagogy and Education Association) funded four knowledge mobilisation scholarships to accumulate and synthesise knowledge relevant to its members, which is relevant to teachers delivering the new computing curriculum in England. Members of the association applied for the fellowships by identifying a specific practitioner need or gap in the knowledge base. The role of the association was to select those topics that were most relevant to its members and fund these. Several subject specialist pedagogy MESHGuides are the result of this partnership with a professional subject association (Cox and Caldwell, 2018; Iredale et al 2018).

Similarly, having identified a pressing need amongst practitioners, the British Association of Teachers of the Deaf (BATOD) was awarded UK lottery funding to develop MESHGuides advising teachers on supporting deaf and hearing-impaired children in the classroom. BATOD brought subject content experts together with teachers and local authority advisory staff to produce MESHGuides on Acoustic Accessibility (see Rosenberg et al., 2016) and other areas (Cued Speech, Radio Aids, Glue Ear) where teachers can benefit from specialist knowledge. As BATOD state,

> "MESH Guides, in its embryonic stage, stand at the juncture between [research and practice] as an opportunity and vehicle to move the wealth of the existing and growing underpinning research for education of the deaf, very actively and pragmatically into the minds and hands of those who are at the chalk face." (Rosenberg, et al., 2016, p.856).

Model 3: Collaboration with individual specialist research institutes
The first two models were firmly rooted in practice with the inspiration for MESHGuide topics arising from the research of teacher educators or from subject associations concerned with teaching and teacher development. However, University-based Research Institutes outside of teacher education departments often generate specialist-subject knowledge that has relevance for subject teachers.

In this case an example of collaboration with a microbiology research unit is the focus. Collaboration between educators and the 'infectious diseases research unit' produced a MESHGuide for early years teachers covering subject-content knowledge and subject-pedagogy on the transfer of viruses and bacteria (Laird et al., 2018).

The UK based infectious diseases research unit worked collaboratively with the Environmental Sanitation Institute (ESI) in India to test out the resources with community health workers and early years teachers. The multi-disciplinary research team developed educational resources for delivery to children, teachers and healthcare workers to reinforce learning about health and hygiene, particularly infection control. The team also delivered a series of workshops to share pedagogic activities, which have since been implemented in schools in the UK and India. MESHGuides are not limited to print. By creating culturally relevant books, online games and posters on hand washing for children in several languages with support from UNICEF, these resources have been tested in workshops and evaluated by the research team. The resources have been collated into a MESHGuide, to make the research globally accessible and free at the point of access. Sponsorship was provided by WaterAid and through crowd sourced funding.

Model 4: Collaboration with an international NGO
The first three models were rooted in the education sector though universities or subject associations. However, another model which has been tested is for the MESHGuide to be commissioned by a non-governmental organisation. Voluntary Service Overseas (VSO) is an independent international development organisation that supported over 2.4 million people in 24 countries in 2016-17 (VSO, 2016-2017). In January 2018 VSO identified a need for research-informed materials to support volunteers working in early childhood education in the Rohingya refugee camps in Bangladesh and approached the MESH network with an invitation to test out the MESH knowledge mobilisation system for use in emergency settings in getting the latest research-based knowledge to users in this case the context was early years education in emergency settings and the users were those in the camps with young children, particularly mothers and big sisters.

Over a twelve-week period, an international MESHGuides advisory board on early years education was established and research knowledge was pooled from 40 educators in six countries and summarised. As a result, an extensive MESHGuide for "Early Childhood Care and Education in Emergencies" was produced, along with summaries for parents and training materials for local community leaders who were then working with these groups (Laxton et al, 2018 a,b,c; VSO, 2018a,b,c,d) .

The outcome as of July 2018 is that early VSO evaluations show that materials which had been translated and adapted to the local context were well received, were being disseminated and cascaded and that children were benefiting (Shresthra, 2018). Ongoing evaluation is being undertaken.

A second stage of the initiative is to share the MESHGuides from mobile phone to mobile phone without access to wireless networks using USTAD technology and following a successful pilot in Afghanistan. The evaluation of the implementation of this model will be reported by VO in due course. A third stage is to adapt the materials to other emergency settings.

Sponsorship was provided by VSO and through a public campaign.

Model 5: Mobilising knowledge from doctoral theses: a national strategy for selection
In the USA, over 5,000 doctorates in education are awarded annually (NSF 2018b). While no global statistics are available, that doctoral study in education is a popular field internationally can be seen by the large numbers of universities worldwide that offer PhD and EdD programmes. The majority of these programmes require their graduates to complete a substantial piece of original research and present this in a thesis or dissertation. While not all doctoral topics will have immediate relevance to education practitioners, a significant proportion of this work may contain knowledge and insights that would help to improve education. However, despite many thousands of doctoral theses being completed each year, the impact of this body of doctoral work on education and teaching is unclear. Liberating such knowledge from doctoral research for practical use by teachers is doubly challenging; not only due to length and time required to read and understand the theses, but also in its use and applicability. While the thesis will be likely to be made available in a university library and published online it may not be easily accessible to the

teachers who might be best placed to apply this knowledge. This is a particular problem for international graduates where a doctorate may have been achieved and published in a different country from that where the data was collected or where the author may have hoped to have most influence. The MESHGuide approach provides a method for sharing doctoral research in an accessible and user-friendly form, thus ensuring that the insights and research from doctoral work are translated widely and that the potential impact on schools, teachers and pupils is maximised.

This case study outlines a process for translating doctoral work into a MESHGuide. At the initial development stage, two of the authors worked with doctoral students from the University of Pretoria to design and trial the process. As a result, six stages to creating a MESHGuide from a doctoral thesis were identified (see Table 2). For an example of a MESHGuide resulting from this process, see Malan Van Rooyen's work (2018) on the A to Z on www.meshguides.org; also other earlier examples from PhD theses are Bhatti (2017), Crawley (2016), Jones (2016).

Table 2: Process for translating doctoral research to a MESHGuide

Stage	Summary
1. Identification and recruitment of authors	Initial identification works on three levels: 1) Participation is sought from a senior representative of an internationally-recognised university 2) University representative identifies key, experienced doctoral supervisors 3) Supervisors identify recent doctoral graduates who have produced relevant, high-quality work The graduates are then approached individually.
2. Clarify requirements	Through the use of guidance documents, example MESHGuides and templates, prospective authors are familiarised with the purpose and structure of a MESHGuide. A key purpose of these resources is to support authors in identifying a suitable topic for their guide and to adopt a suitable writing style. Once a topic is proposed, the MESH Editorial Board check for potential duplication with other guides before writing begins. Once the proposal is approved, authors are allocated a subject-specific editor who can support them throughout the process.
3. Draft	The author translates the knowledge, insights and concepts from their doctoral research into the MESHGuide format (with support from an editor as required). As the existing MESHGuides share a common structure that has been proven to work for a number of topics, this can provide a supportive framework to help the writing process.

4. Edit Peer review by academic experts Quality assurance process step 1	The first draft of the guide is peer-reviewed by the subject-specialist editor. They check that the guide meets the requirements of the MESHGuide format and that it is of an appropriately high quality. The editor may suggest revisions that the author will need to make before the guide can be accepted.
5. Test 'Translating' into practice Practitioner review Quality assurance process step 2	Once accepted, the draft guide is then tested by teachers. The author or editorial board will nominate two or three individual teachers to read the guide and to comment on its relevance and clarity. Any subsequent revisions will then be made by the author before moving to the final stage. Elements of these teacher peer-reviews may be published alongside the completed MESHGuide, providing a dynamic feedback loop from practitioners. .
6. Publication Innovative 'online knowledge maps' with graphical interface Updatable: developing a dynamic knowledge-base Dynamic: providing a continual feedback loop from academic researchers and practitioners	After testing is complete, the subject specialist editor will pass the MESHGuide to the General MESH Editorial Board for final approval. Once accepted, the draft MESHGuide is converted to the online format by the web-publishers and published online. The publication is then announced through the MESH newsletter and social media channels. MESHGuides should be updated as new evidence and research emerges. Over time, teachers (users and readers) may suggest updates. Also the author may wish to update the evidence in their guide. Suggested updates will normally be decided by the original author and agreed with the relevant editorial board. After an agreed time, the author will also be asked to review the MESHGuide they have created to ensure it remains up-to-date.

DISCUSSION: Common Features of an emerging model for a Translational Research System

The five models introduced above illustrate how different partnerships have implemented the MESH system and developed translational research practices for the teaching profession. Each of these processes is the subject of regular evaluation and review so that they can be further refined and improved. While the models differ in significant ways, we can identify a number of common features that define a Translational Research System, including: engagement with stakeholders throughout the whole process; quality assurance, democratic participation.

Engagement with Stakeholders

All five models include the dynamic engagement of end-users (teachers) with researchers. The aim of translational research is to provide a bridge between research findings and practitioners such that the research can be translated into practice. Arguably the MESH system provides an innovative methodology that utilises a number of different models to harvest research for practitioners; specifically teachers for their professional practice and to facilitate the move towards research-informed teaching. The models demonstrate that the stimulus for creating a MESHGuide can come from researchers (including doctoral students) but can also arise directly from the needs of practitioners via subject associations or non-governmental organisations.

It is vital that MESHGuides are accessible for teachers and this is ensured through several features of the models. Firstly, from a very earlier stage, **training** is provided to ensure that the authors understand the purpose and structure of a MESHGuide and, in particular, understands how the writing style of such a guide differs from that of other research reports. This can be achieved through virtual or face-to-face meetings (e.g. Model 4) or through guidance materials (e.g. Model 5). The structure of the guides also helps to ensure that the author is focused on how their work might be applied, for example, through the inclusion of case studies, interventions, and instructions for using the guide. Finally, a test phase ensures that practitioner **feedback** is integrated into the MESHGuide and that potential misunderstandings are avoided.

There are several potential developments that can already be identified as worth considering. Firstly, Flynn (2018) suggest that it is beneficial for practitioners to be involved earlier in the drafting of a MESHGuide. In their development of a MESHGuide to support the teaching of bilingual learners (Model 1), early involvement by teachers improved the quality and relevance of the final guide.

Democratic Participation

The act of creating a MESHGuide might be conceived as a moment of increasing participation in an international educational community (communal constructivism). The models value the work of practitioner and doctoral students as well as that of established researchers. While some MESHGuides are the product of experienced researchers working in national funded research institutes and universities (e.g. Model 3), the range of models discussed here ensures that MESHGuides can be written by those in less powerful positions in academia. Also, these processes enable teachers to have a voice as end-users and comment on the guides for practice, both prior to publication, when in the role of peer-reviewers, and through giving feedback once published. In fact, the MESH process sees Guides not as 'completed' or 'final', but as requiring regular updating and revision to reflect new research findings. This in turn forms a 'dialogue', a dynamic approach that allows for the possibility of the creation of new knowledge, in the form of communal constructivism (Leask & Younie, 2001), which acknowledges the role of teachers' situated knowledge construction and draws on theories of distributed cognition, situated learning, and social constructivism. The technology used in the creation and maintenance of the guides thus lead to new ways of working using digital tools.

Quality Assurance

For MESHGuides to be accepted and implemented by practitioners, it is vital that the research underpinning the guides is of high quality and that the translation to practice of these findings is fully warranted by the evidence available. Therefore, all models have to pay careful attention to how they assure the quality of the guides. For example, in Model 5, we can rely on the quality assurance processes, reputation and expertise of the university to provide some confidence in the quality of the work, which is further verified through the role of external examiners. It is important that experts within a country

identify that potential universities are genuine, respected institutions that follow the expected quality assurance processes of their host country. It is not expected that universities from different localities will have the same processes or expectations, but they must be well-respected within their country and preferably internationally. For the first stage of doctoral MESHGuides (Model 5), MESH has worked with an internationally recognised, highly-ranked, research intensive university.

Once the institution has been identified, the next stage of Model 5 is to select key doctoral supervisors who work in areas of relevance to education and who have a track record of supervising high quality doctoral students. These supervisors can be identified and approached by senior academics within their university. The identified supervisors then select those doctoral students that they believe are producing work that could be suitable for a MESHGuide. These will either be recently completed graduates or close to submission of their thesis. This three-part identification process assures the quality of the research at three levels: university, supervisor and student, and ensures that the research that the guide will be based on is rigorous and has already been subjected to a stringent examination process, via internal and significantly external examiners. This process, therefore, relies on the quality assurance and academic judgement of participating universities, as well as the process of quality assured peer-review of the MESHGuide publishing procedures. This process of 'translating research' from doctorates is efficient and takes advantage of the high level of accountability that universities face.

The Translational Research System

The five models demonstrate effective ways of building partnerships with a range of different stakeholders in order to mobilise knowledge to support research-informed teaching. As new partnerships explore how they can make use of the MESH TR approach, these models provide templates for action. We propose that the common features of these models should be the essential components of future partnership models.

Figure 2 summarises the common features of the models. A model is described typically as an inputs, processes and outputs system. In this case, the MESH TR System includes *inputs* from a broad range of partners including researchers, practitioners and organisations. It proposes *processes* that are mediated by principles of stakeholder engagement, democratic participation, and quality assurance. And it results in *outputs* that are dynamic MESHGuides that are updated and reflect the current thinking and research of the communities that created it. These key elements are summarised in Figure 2.
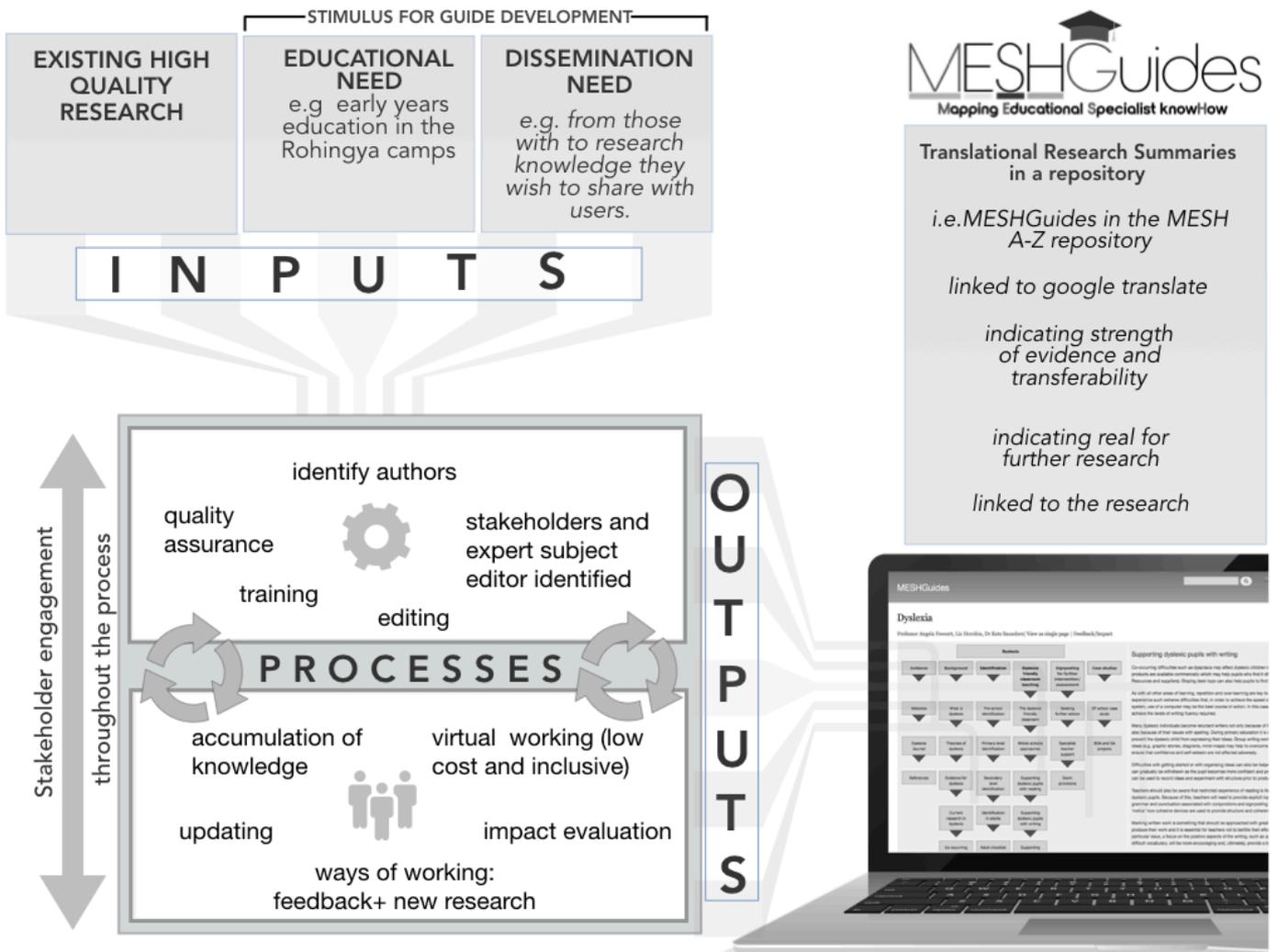
. *Figure 2 - Summary of common features of the inputs, processes and outputs of the MESH Translational Research System*

CONCLUSION

Despite the successful development of knowledge management and research-informed systems in the healthcare, engineering, nuclear industries, and defence sector, there has been limited success in creating similar systems for education. Arguably there is no justification for knowledge management standards and practices in the education sector to be lower than those expected of other sectors of the economy.

Similarly, while translational research is a concept and practice well established in the medical sector it is under-theorised and little known in education systems.

The paper has set out a low-cost sustainable system, with an innovative methodology that includes a variety of models for translational research in education, with specific roles for education stakeholders. Specifically it outlines how collaborative partnerships can facilitate the harvesting of research knowledge from organisations (such as NGOs, research institutes, professional subject associations and other relevant

stakeholders) to provide a way to realise the vision of teachers anywhere to have access to up-to-date subject-content, and access to the latest pedagogic research relevant to concepts in their subject.

Governance of an international TR knowledge management system is, however, a challenge. As Blamires (2015) has shown, realising research-informed practice for teaching is costly if existing resources are not maintained. In addition, individual countries (developed and developing, particularly those with small populations and small economies) cannot keep teachers updated in all subject areas if they work alone.

The authors conclude after careful analysis that the challenge of providing a global educational knowledge management system is larger than any one individual country can manage except perhaps countries with large economies. This led the EFC Global Summit (EFC, 2016, 2017) to propose establishing an international collaboration, a World Education Council, to lead in this endeavour and provide coordinated leadership. Educators across countries are giving their time and support to create the MESH system, freely sharing research knowledge for the greater benefit of all. However, a World Council for Education could harness and coordinate efforts more effectively. Successful developments in different contexts in other disciplines e.g. Cochrane Collaboration, European SchoolNet, Wikipedia provide models of governance and funding which provide a sound foundation for scaling up the MESH TR system for education.

This paper outlines translational research models for mobilising research knowledge to support research-based teaching which can be used by NGOs, charities, governments, professional associations and research-institutes. The models coupled with the curating the TR in one repository (like Wikipedia) provide a resource to support upskilling teachers everywhere and a means of supporting UNESCO's SDG 4c.

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[1]Knowledge management refers to a system in which individuals, organisations and sectors can: find, use, share, create and manage knowledge relevant to their field.
(2) See for example, UK Cambridge University's Office for Translational
Research (http://otr.medschl.cam.ac.uk).

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