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Science and Technical Communication for Knowledge Translation

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Abstract - In the broader field of science and technical communication, the translation and transfer of expert and technical knowledge is an enduring preoccupation. While research in science and technical communication has studied the importance for practicing scientists, engineers, and technical communicators to transfer knowledge in and beyond their specific settings, there are fewer engagements with training science and technical communicators to disseminate knowledge to outside stakeholders as an integral component of scientific research itself. The concept of knowledge translation we will analyze aims to put knowledge into action by tailoring communication approaches to reach dissemination and implementation goals for specific audiences, such as other researchers, clinicians and practitioners, funders, managers, policy-makers, and the public. We argue science and technical communicators have the rhetorical skills to be leaders in conceptualizing and implementing knowledge translation. In our short paper, we will introduce knowledge translation and differentiate it from similar terms such as technology transfer, knowledge transfer, and boundary spanning. We will then describe how the rhetorical skills of science and technical communicators address the steps and goals of knowledge translation. We will conclude by offering a teaching prompt to show how knowledge translation can be practiced in the science and technical communication classroom.

Index Terms – science communication, knowledge translation, health communication, genre knowledge, usability, information design

INTRODUCTION

In the broader field of science and technical communication, the translation and transfer of expert and technical knowledge is an enduring preoccupation [1-5]. While research in science and technical communication has studied the importance for practicing scientists, engineers, and technical communicators to transfer knowledge in and beyond their specific settings, there are fewer engagements with training science and technical communicators to disseminate knowledge to outside stakeholders as an integral component of scientific research itself. The concept of knowledge translation we will analyze aims to put knowledge into action by tailoring communication approaches to reach dissemination and implementation goals for specific audiences, such as other researchers, clinicians and practitioners, funders, managers, policy-makers, and the public. As such, it differs from commercialization and technology transfer as it aims to ensure the appropriate use of knowledge in decision-making while taking into account the process of doing so for various stakeholders [6]. Knowledge translation is increasingly a requirement of funding agencies across scientific disciplines and national contexts [7]. We argue that science and technical communicators have the rhetorical skills to be leaders in conceptualizing and implementing knowledge translation. In our short paper, we will introduce knowledge translation and differentiate it from similar terms such as technology transfer, knowledge transfer, and boundary spanning. We will then describe how the rhetorical skills of science and technical communicators address the steps and goals of knowledge translation. We will conclude by offering a teaching prompt to show how knowledge translation can be practiced in the science and technical communication classroom.

WHAT IS KNOWLEDGE TRANSLATION?

Knowledge translation refers to the process of putting knowledge into action by moving research from the scientific community to other audiences that can put it into practical use, thus increasing research use, uptake, and implementation [8]. As such, it also aims to reduce the "know-do gap," or knowledge-to-action gap, where much robust scientific knowledge is not used to design action [9]. To do so, communication approaches are tailored to reach dissemination and implementation goals for specific audiences, such as other researchers, clinicians and practitioners, funders, managers, policy-makers, and the public.

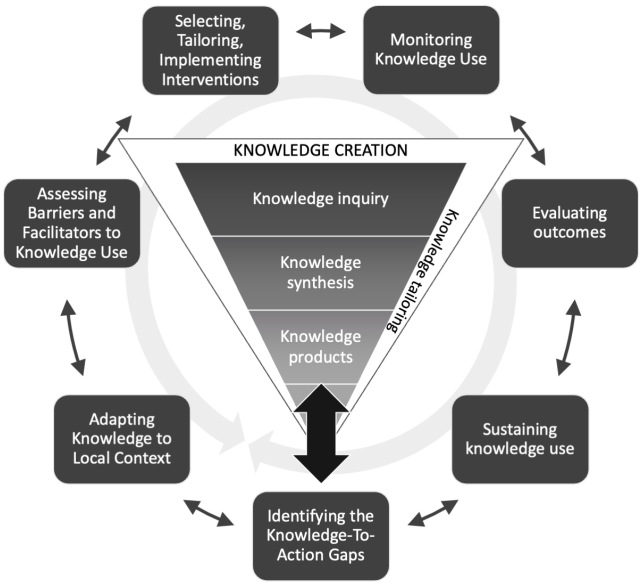
While "knowledge translation" is a frequently used term, McKibbon et al. [10] identified 100 terms that are closely related to knowledge translation. Some terms sometimes used as synonyms include knowledge transfer, knowledge mobilization, knowledge exchange, knowledge uptake, knowledge use, knowledge-to-action, dissemination and diffusion, research use, research utilization, and implementation science. The term knowledge translation became used more widely in the scientific literature after the Government of Canada founded the Canadian Institutes of Health Research (CIHR) and included knowledge translation in its mandate [11-13]. The term was then taken up by other agencies, including the Center on Knowledge Translation for Disability and Rehabilitation Research (KTDRR) at the American Institutes for Research [14] and the World Health Organisation (WHO) [15, 16].

Other terms can be confused with knowledge translation but refer to other concepts or processes. For example, knowledge translation differs from commercialization and technology transfer, which is better known by many science and technical communicators [1, 2, 5]. Indeed, while commercialization involves the external exploitation of knowledge for compensation [17] and technology transfer is specific to technology-related exchange [18], knowledge translation aims to ensure the appropriate use of knowledge in *decision-making* while taking into account the process of doing so for various stakeholders [6, 8]. Knowledge translation is also sometimes conflated with continuing education and continuing professional development, but while educational interventions are one strategy for implementing knowledge [6, 8], and may thus be a strategy used in knowledge translation, other strategies may be used depending on the audience and the knowledge being translated. Furthermore, continuing education and professional development are not always effective in changing practitioner behavior, making other knowledge translation tools and settings important for producing change and reducing the knowledge-to-action gap [19].

Because of the importance of publicly funded research having returns on investment for the population, knowledge translation is increasingly a requirement of funding agencies across scientific disciplines and national contexts [7, 20, 21], especially for applied health and social research. With knowledge translation being increasingly required by public funders, health and social researchers are now expected to integrate this additional component into their research process. Some researchers try to gain some expertise in knowledge translation, while others collaborate with community agencies to disseminate their findings. Some teams and agencies also employ knowledge brokers (i.e., people engaged in multiple functions to facilitate or lead knowledge translation, including capacity building, dissemination, and relationship building), intermediaries (i.e., organizations dedicated to and engaged in knowledge translation), or boundary spanners (i.e., people or organizations engaged in relationship building, enabling the exchange between knowledge producers and users to facilitate knowledge translation) [4, 22]. We argue that science and technical communicators have rhetorical skills to be leaders in conceptualizing and implementing knowledge translation. Specifically, science and technical communicators can draw on their knowledge of genres to tie together issues of audience, purpose, context, and action, as well as their identity as "articulat[ors] of voices" where they bear responsibility for fashioning the relationship between authors and audiences [23, 24]. By foregrounding these and other skills such as usability methods and information design, science and technical communicators could be key collaborators in interdisciplinary research teams by developing knowledge translation strategies and tools, either as the knowledge broker for the project, or the team member leading collaborations with community organizations, knowledge brokers, intermediaries, and boundary spanners. Below we describe the knowledge to action cycle and suggest points at which science and technical communication expertise may be especially helpful.

THE KNOWLEDGE-TO-ACTION CYCLE

Many theories and models of knowledge translation have been developed. One of the most used, including by the CIHR [25], is the knowledge-to-action cycle developed by Graham et al. [26] after reviewing over 30 theories related to knowledge translation and identifying their common elements. This cycle, shown in Figure 1, involves an iterative, dynamic, and complex process that includes both knowledge creation and knowledge implementation.



Source: Adapted from Graham et al. [26] and Straus et al. [6].

FIGURE 1. THE KNOWLEDGE-TO-ACTION CYCLE.

Knowledge creation (i.e., production) includes three phases. Each phase yields knowledge that is more synthesized and refined, increasing its potential usefulness for knowledge users. Knowledge inquiry produces first generation knowledge derived from primary studies (e.g., observational studies, randomized controlled trials). Knowledge synthesis consists in literature reviews (including, e.g., scoping reviews, systematic reviews, meta-analyses) producing second generation knowledge where individual studies/first generation knowledge is synthesized [6]. Because results of individual primary studies can be biased and/or misleading, knowledge syntheses and reviews are often considered the base unit for knowledge translation [6, 26-28]. Knowledge products (or tools) are third generation knowledge consisting of tools and products that aim to present first- and second-generation knowledge in a more user-friendly manner, for example by deriving decision aids, clinical practice guidelines, and educational modules [6]. Knowledge creation informs the action cycle, which as shown in Figure 1, consists of seven steps that can interinfluence each other. Further, the action cycle can itself influence knowledge creation in an iterative process where the needs and problems of knowledge users inform future research, syntheses, or tools [6]. Science and technical communicators have the skills necessary to contribute to this entire action cycle of knowledge translation, as detailed step-by-step below.

PHASES OF THE ACTION CYCLE

The action cycle is iterative. While there is some linearity where phases build on each other, they also interinfluence each other, and results from one phase may result in revisiting previous phases.

I. Identifying knowledge-to-action gaps

Identifying knowledge-to-action gaps is the first step of knowledge implementation. This may come from first being aware of new knowledge (e.g., knowledge syntheses or products) and then examining whether this knowledge can fill a knowledge-practice gap. Alternatively, knowledge users or other identities can find that there is a problem that needs appropriate solutions, and knowledge is identified to fill that gap [6, 25, 26]. Depending on the available knowledge, the identified needs could lead to first, second, or third data generation. This is why knowledge creation and the action cycle can interinfluence each other.

Identifying the knowledge-to-action gap often involves needs assessment, from the perspective of the targeted population (e.g., general population, organization, practitioners, policy-makers) [25]. Science and technical communicators may see this situation as a rhetorical one, where an exigency needs to be identified and articulated through rhetorical tools that surface audience concerns, needs and desires [29, 30].

II. Adapting knowledge to local context

Adapting knowledge to the local context involves two main activities. First, the knowledge is assessed regarding its relevance, utility, and appropriateness for the setting targeted by the knowledge translation efforts. Second, the knowledge itself may be adapted for use by that setting and context [25, 26]. For example, recommendations stemming from research in one country may need to be adapted for a different local context.

III. Assessing barriers and facilitators to knowledge use

Next, barriers and facilitators to knowledge use are assessed. As knowledge translation efforts often aim to trigger change, potential barriers and facilitators for that change in knowledge users are identified to inform intervention strategies [6, 26]. This step is important to ensure the knowledge translation strategy has the best effect possible, with a review showing that interventions that are tailored to identified barriers are more likely to change professional practice [31]. Assessments of barriers and facilitators often rely on data gathered from focus groups and interviews with stakeholders. Usability research could be added as a component of data gathering, bringing to the assessment knowledge of the system in which an intervention will be brought and opening a space for collaboration on implementing a new intervention into a new context [32, 33].

IV. Selecting, tailoring, implementing interventions

In this phase, interventions are selected and tailored based on the information gathered in the other phases. Strategies to promote the use of knowledge are developed and implemented. This is the phase most often equated with dissemination, where the message is tailored for the targeted audience of knowledge users [25, 26]. By adapting insight from information design, science and technical communicators can assure a smoother transition from phase III to phase IV. Information design is not simply a matter of creating documents or websites for audiences. It is a design practice initiated from a thorough understanding of user needs, genre effects/affects, and context [34].

V. Monitoring knowledge use

After the knowledge translation interventions have been developed and implemented, knowledge use or application is monitored [6, 26]. This is necessary for determining whether the intervention had the intended effects in reducing the knowledge-to-action gap. Before doing so, knowledge use must be defined for the specific context to allow its measurement. Often, knowledge use is thought to fall within three main categories [35, 36]: conceptual

knowledge use involves changes in understanding and attitudes, instrumental knowledge use involves the concrete application of knowledge, or changes in behavior or practice, and persuasive knowledge use involves the use of knowledge to attain specific power or profit goals. Usability research may be deployed to assess users' needs during the process of knowledge adoption and design anticipatory interventions for developing issues.

VI. Evaluating outcomes

This phase evaluates the impact of knowledge use, or of reducing the knowledge-to-action gap. Here, the evaluation goes beyond simple knowledge use, to examine whether knowledge use had an impact on health, providers, systems, governments, populations, etc. The level of impact depends on the knowledge being translated and the target users, but the outcomes here aim to look at whether knowledge use had a positive effect. This helps in determining whether the knowledge translation efforts had impacts and were thus worth it [6, 26]. To do so, the outcomes that we aim to influence through reducing the knowledge-to-action gap need to be clearly defined.

VII. Sustaining knowledge use

Knowledge use is sustained by maintaining the use of knowledge and/or continually implementing evidence over time. Routinization, receptivity to change, budgetary concerns, human resources, as well as barriers and facilitators to ongoing knowledge use may need to be taken into consideration in this phase [6, 26]. Overall, the same process can be used for sustaining knowledge use, thus creating a feedback loop back through the action cycle [26].

MOVING FORWARD WITH SCIENCE AND TECHNICAL COMMUNICATION FOR KNOWLEDGE TRANSLATION

The above is a sketch of the knowledge translation process. Scientists and granting agencies recognize that science needs to make more meaningful connections between labs and the people that could use their research. The turn of focus to knowledge translation admits an important fact about science that science and technical communication has long sought to make: namely, the reality and utility of science are bound up with the language used to disseminate it [37, 38]. At various stages within the knowledge translation process, we can see where science and technical communicators can bring their rhetorical knowledge and diverse skill set to meet shifting exigencies of communicating to stakeholders. The knowledge translation process is conscientious about the nature of good communication; it does not operate on the assumption of a sender to receiver model, but instead understands communication as an activity of embedding knowledge in contexts and habits. Science and technical communication has worked to develop a thorough understanding of how information must address rapidly shifting contextual particularities [39, 40]. Several of the more pertinent abilities of science and technical communicators include usability research, genre knowledge, and information design. We therefore call for science and technical communication research and education to make specific connections between their field and knowledge translation. We speculate that knowledge translation efforts will increasingly become a part of scientific, technical, and medical research funding, and so an opportunity will arise where science and technical communication can position their expertise as crucial to scientific knowledge creation.

We want to take the first preliminary steps to thinking about this turn by acknowledging a couple of the more glaring limitations of our presentation of knowledge translation. In addition to the brevity of the research presented here, we have not conceived of knowledge translation from *within* a science and technical communication framework. We have opted for a "drop-down menu" type of effort in order to establish kindred aims and abilities between knowledge translation and science and technical communication. Thinking about the goal of knowledge translation from within our own ethical and conceptual frameworks would allow us to perhaps offer something competitive to the knowledge translation expertise that already exists and would allow us to address pitfalls of too eagerly putting ourselves at the service of an enterprise without establishing our place within it. By that we allude to common concerns of science and technical communicators of being treated as scribes in the research process, of having no outlet for our knowledge of how rhetoric impacts not just the dissemination, but the constitution of scientific knowledge [41, 42], of our reification of a deficit model of science communication [43, 44]. Knowledge translation as already conceived obviates the threat of some of these concerns, but a thinking through of its goals from our own expertise and traditions puts us in a better position to make a sustainable contribution.

One more preliminary step we wish to take is offering a course project for instructors to help students think like a knowledge translator. We conceive of the following exercise as something appropriate for an upper-level undergraduate or Masters-level course. We suggest having students research a current scientific or medical topic. Students will then write a literature review of the topic summarizing the state of the art. Here we have conventional science writing skills employed. To move towards a knowledge translation perspective, we suggest students perform an audience analysis of who could benefit from the research they have reviewed. Students will not only identify possible stakeholders and interested parties, but additionally, compose an information design plan detailing genres and modalities that would not only reach,

but make the biggest impact on possible audiences. A final deliverable could be a visualization of that plan.

This course project employs knowledge and skills science and technical communicators already have some facility with, but directs them towards the goals of knowledge translation and of reducing the knowledge-to-action gap. Projects or classroom exercises in the same vein can help students think about articulating research by bringing together elements of genre or design to put science within the grasp of the people and institutions that could make the best of use of it.

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