

Teaching Young People to Think Critically about Health Claims and Choices

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Why Teach Critical Thinking about Health Choices?

PEOPLE EVERYWHERE ARE bombarded by family, friends, health personnel, marketers, governments, and others with many unreliable claims about what to do to protect or improve their health (Haber et al. 2018; Walsh-Childers et al. 2018). During the COVID-19 pandemic, a tsunami of health information about “what works” or “doesn’t work” has resulted in what the World Health Organization calls an “infodemic” (Zarocostas 2020): an overabundance of information, including both reliable and unreliable claims about the effects of treatments or preventive interventions (such as vaccines), that makes it hard for people to find trustworthy guidance. This flood of contradictory and uncertain information in the wake of the COVID-19 pandemic has brought public attention to the importance of an already existing problem: many people lack the ability to apply basic principles for distinguishing between reliable and unreliable claims and evidence and using this information to make informed decisions (Boutron et al. 2019; Dahlgren et al. 2021).

We define a health intervention, broadly, as an action that can improve (or potentially harm) our health—such as taking medication, using dietary supplements, administering traditional remedies, getting an operation, using equipment or devices, exercising, changing diet, or undergoing physical or psychological therapies. Health interventions may also include actions aiming to improve public health, such as closing schools or issuing face mask mandates to stop the spread of infectious diseases. Believing in and acting on unreliable claims about the effects of health interventions can lead to harm, waste of personal or public resources due to overuse of services (Brownlee et al. 2017), or resistance to health actions that might be helpful (Glasziou et al. 2017).

People in low-income settings are disproportionately affected by unreliable claims about health interventions because they can least afford to waste resources. However, people everywhere need skills to distinguish between reliable and unreliable claims when making decisions about what to believe and what to do. Without these skills, we are more vulnerable to being misled by misinformation, both online and elsewhere.

How Do People Make Judgments about the Reliability of Health Information?

Believing a health claim to be “reliable” means perceiving that it can be trusted. While researchers are trained to appraise the strength of evidence in their respective fields through established, systematic approaches, non-researchers will likely use less rigorous strategies. A systematic review of the criteria and indicators that consumers use to evaluate the quality of online health information defined low-quality information as “information that is inaccurate, incomplete, or biased” (Sun et al. 2019). Researchers found twenty-five criteria across three aspects of the information itself: design, source, and content. For instance, people may base a quality judgment on whether the appearance of a website is visually appealing; whether the source is familiar, popular, or easy to access; or whether the message is written in plain language, error-free, and found across multiple sources (giving the impression of consensus). The ways people evaluate quality vary broadly and are highly subjective and context-dependent. For example, laypersons are more likely to base judgments about information quality on superficial features, such as professional-looking design, than experts in that field (Stanford et al. 2002).

Brashier and Marsh present an overview from a cognitive processing perspective of how people construct a judgment of truth (Brashier and Marsh 2020). They found three categories of information that people use: base rates, feelings, and consistency with information retrieved from memory. This means, among other things, that the way people feel about a message (e.g., if it is easy to understand), and if they have seen it before, impacts their judgment about whether to believe it or not.

Shortcomings of Intuitive Strategies

Many conscious or unconscious strategies people employ to evaluate quality or make inferences about the trustworthiness of information are ill-suited for making accurate assessments about the reliability of claims about health interventions. Unreliable claims can be found on visually appealing platforms, promoting messages that “feel right” and are easy to read; a misleading claim may spread quickly across a wide network of platforms, so people see it “everywhere.” Relying solely on the advice of experts can also be tricky, as experts may openly disagree (Nagler et al. 2020).

Solutions are not straightforward. Labeling information as coming from “research” is not sufficient: a survey commissioned by the UK Academy of Medical Sciences reported only 37 percent of the public said they trusted evidence from medical research, compared with 65 percent who trusted the experiences of their friends and families (Academy of Medical Sciences 2017). Merely pointing to government sources may not be effective. Government institutions, such as health authorities, may be juggling conflicting roles of providing the public with balanced information as well as issuing public health recommendations or mandates that they want people to comply with. This could lead them to (intentionally or unintentionally) present information in ways that distort the effects of interventions, exaggerate the benefits, or downplay potential harms (Oxman et al. 2022).

Additionally, not all people value the same sources. While many people consider government institutions to be reliable sources of health information, others are highly skeptical of information coming from authorities. A study from 2020 estimating the prevalence of conspiracy thinking among adults in the United Kingdom found that a surprisingly high number of participants exhibited mistrust in government institutions and experts, well beyond the fringe population that authors expected to find. People who perceive themselves to be socially mar-

ginalized are particularly skeptical (Freeman et al. 2020). Although important, merely teaching people to think critically about the *source* of information is not sufficient to equip them with the skills they need to differentiate between reliable and unreliable health claims.

Our Approach to This Problem

Rather than promoting skills to think critically about information sources, the Informed Health Choices (IHC) team has taken a different approach. We aim to build people's capacity to identify and think critically about the *basis* for a claim (e.g., the supporting evidence) and about the effect of health interventions, and to apply this knowledge when deciding what to believe and do. These skills can be applied to personal choices about health interventions or to debates or decisions about public policies (Informed Health Choices, n.d.).

The IHC team is a multidisciplinary, international collaboration established in 2012. We are a core group of partners in Norway, Uganda, Kenya, Rwanda, United Kingdom, and Chile, with a secretariat at the Norwegian Institute of Public Health, and additional teams participating in various related projects on five continents (Informed Healthcare Choices Group 2020). We develop, evaluate, and contextualize open access learning resources using mixed research methods and human-centered design. This chapter is about our collective efforts; therefore, "we" in this text means teams of the core IHC partners as well as some teams in the network.

Below we describe how we developed and evaluated primary school learning resources (for children ages ten to twelve) in collaboration with teachers, students, and other relevant stakeholders in East Africa, with funding from the Norwegian Research Council, and how others are contextualizing them for use in many other countries around the globe.

Why Start with Young People?

Children and teenagers make choices that impact their health, both in the presence or absence of parents or guardians. Teaching them critical thinking skills early in life can help equip them to make better choices now and later as adults. It might improve academic achievement more broadly (Pellegrino and Hilton 2012) and can help to foster desirable dispositions (Abrami et al. 2015), such as questioning the basis of claims more generally. Moreover, because misconceptions, attitudes, and behaviors developed during childhood may be resistant to change later as children grow older (National Research Council 1999, 2007), it is important to encourage critical thinking early.

Teaching people at an early age also means reaching a large segment of the population who do not have the same learning opportunities later (Unesco 2019). In several parts of the world, particularly in Sub-Saharan Africa, a high proportion of the total population is made up of young people. In Uganda, for instance, where the piloting and evaluation of the primary school resources took place, 48 percent of the population was fourteen years old or younger in 2017 (National Population Council 2017), and a third of Ugandan children who complete primary school do not advance to the next level of education (Tamusuza 2011; Deininger 2003). This is not unique to Sub-Saharan Africa; on a global scale, one-sixth of adolescents and youth are out of school.

Children have the developmental capacity to learn to think critically about claims and the strength of supporting evidence (Sandoval et al. 2014; Duschl, Schweingruber, and Shouse

2007). Learning about fair comparisons (controlled research) is already a part of the curriculum in several countries (Oxman and García 2020; Biesty et al. 2020).

A systematic review of educational interventions that aimed to improve people's ability to appraise health claims showed that educational approaches have the potential to improve knowledge and skills, both in adults and children. However, studies were of varying quality and many only measured effects in the short term (Cusack et al. 2018).

What Do People Need to Learn?

Our first step in developing an educational intervention was to establish what people needed to learn. Authors of *Testing Treatments* (Evans et al. 2011) sought to explain to a lay audience how we know if a treatment works, how we know if it has harms, and how we weigh benefits against harms to determine the risk. Building on these basic learning goals and drawing on a broader body of related literature (Oxman, Chalmers, and Austvoll-Dahlgren 2018), we developed a set of building blocks for educational interventions: IHC Key Concepts (Informed Health Choices Group 2019b). These forty-four concepts are categorized into groups of concepts about “claims,” “comparisons,” and “choices.” See table 11.1 for examples of some of the concepts.

The IHC Key Concepts serve as standards for judgment, or principles for evaluating the trustworthiness of treatment claims, comparisons, and choices. The list of concepts forms a framework from which educators or researchers can develop learning resources tailored to

TABLE 11.1
Key Concepts Included in the IHC Primary School Resources

Category	Key Concepts in IHC Primary School Resources*
Claims: <i>Recognizing claims about the effects of treatments that have an unreliable basis</i>	<ul style="list-style-type: none"> • Treatments may be harmful • Personal experiences or anecdotes (stories) are an unreliable basis for assessing the effects of most treatments • Widely used treatments or treatments that have been used for a long time are not necessarily beneficial or safe • New, brand-named, or more expensive treatments may not be better than available alternatives • Opinions of experts or authorities do not alone provide a reliable basis for deciding on the benefits and harms of treatments • Conflicting interests may result in misleading claims about the effects of treatments
Comparisons: <i>Understanding whether comparisons of treatments are fair and reliable</i>	<ul style="list-style-type: none"> • Identifying the effects of treatments depends on making comparisons • Apart from the treatments being compared, the comparison groups need to be similar at the beginning of comparison (i.e., “like needs to be compared with like”) • If possible, people should not know which of the treatments being compared they are receiving • Small studies in which few outcome events occur are usually not informative and the results may be misleading • The results of single comparisons of treatments can be misleading
Choices: <i>Making informed choices about treatments</i>	<ul style="list-style-type: none"> • Decisions about treatments should not be based on considering only their benefits

*These are taken from an early version of the full Key Concepts, which is updated annually. For the most recent version of all Key Concepts, see www.informedhealthchoices.org/key-concepts.

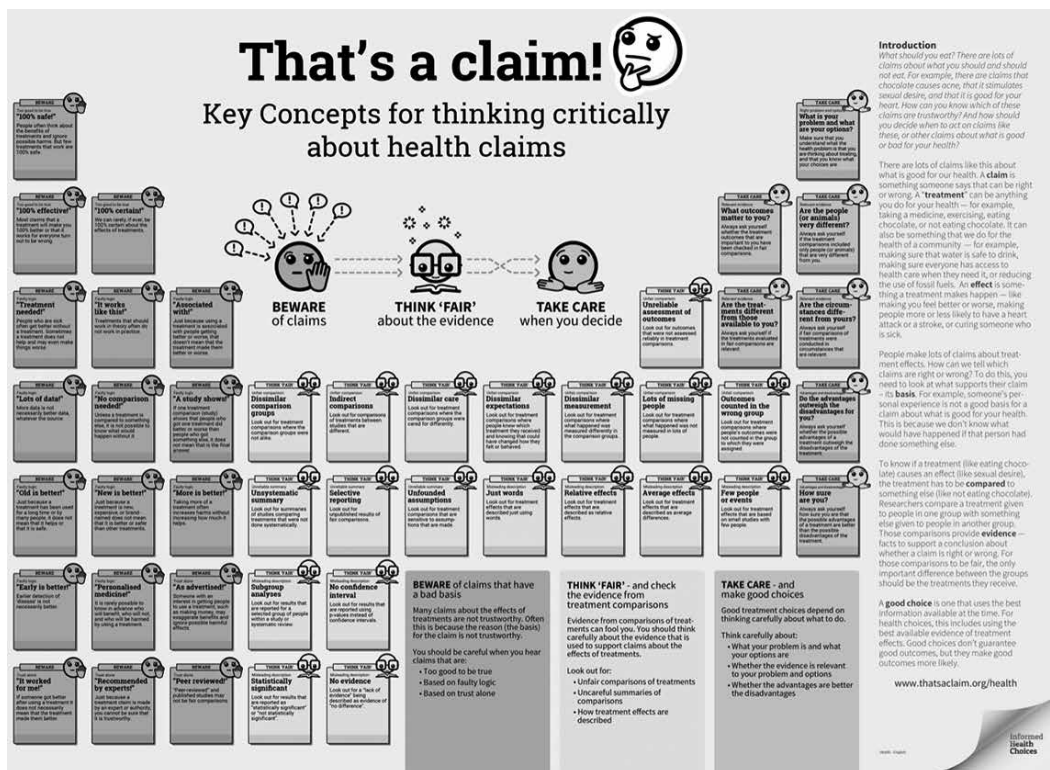


FIGURE 11.1
Poster of IHC Key Concepts for Health Claims, Accessible at Thatsclaim.org.

different audiences or media and create questions to evaluate learning impact (see CLAIM Evaluation Tool described in more detail below). The list also functions as a taxonomy for tagging related learning resources (James Lind Initiative, n.d.).

Not all IHC Key Concepts can be taught at the same time or to the same age groups but should ideally be introduced and repeated over several school years in a spiral curriculum. The IHC primary school resources are based on twelve of the forty-four concepts (table 11.1), prioritized together with educators early in the development phase of that work, according to what students at that age could be expected to learn and how much time there was to teach concepts in one semester (Nsangi et al. 2015).

Additionally, researchers in other fields have adapted Key Concepts to thinking critically about the effect of agricultural, educational, environmental, management, and speech and therapy interventions (Aronson et al. 2019) (Informed Health Choices Group, n.d.-d).

Developing IHC Primary School Learning Resources

To develop the learning resources, we used a human-centered design approach (Giacomin 2014) characterized by the participatory involvement of multiple key stakeholders and rapid cycles of creating and testing prototypes. We worked closely with key stakeholders, international and national advisory groups, and networks of teachers and students in partner countries throughout the two-year developmental phase (Nsangi et al. 2020).

Context Constraints and User Needs

To understand the school context and teacher/student needs, we organized workshops with teachers in Uganda, visits to some of their schools, and piloted early prototypes with students (some of which we also tried out in Norway). We discovered many constraints: basic materials were scarce, electricity was unstable, internet was not available in classrooms and equipment was mostly limited to blackboards, classes were often very large (i.e., during our trial, the teacher–student ratio was on average 1:69), resources for teacher training or printing were lacking, and school timetables were full. Although teachers felt the content was important to teach, it fell outside of their current curriculum and was new to them, making them prone to adding incorrect interpretations or examples. Additionally, although English was the official language at school, many students spoke other languages at home and struggled to some degree with English. We aimed therefore to develop resources that:

- Appealed to both teachers and students
- Could be taught over one semester (ten weeks) by a teacher without prior in-depth knowledge
- Were feasible to use in very large classrooms
- Were designed for children with varying levels of English literacy or who were learning English as a second language

Designing and Piloting Prototypes

After prioritizing a set of IHC Key Concepts that were teachable and relevant to primary school students (Nsangi et al. 2015), we carried out cycles of development over a two-year period: generating ideas, prototyping, and user and pilot testing with students and teachers in Uganda, Kenya, Rwanda, and Norway.

Several of our early ideas that worked in smaller Norwegian piloting environments, such as learning games, failed miserably in larger classrooms that were common in many places in Uganda. The initial pilots in Uganda highlighted two major problems. First, it was challenging to organize games and activities in classes with seventy to one hundred children. Second, the Key Concepts were new to the teachers, and they expressed a need for support or training. Implementing an extensive training program was not only unfeasible for our project, but it was unsustainable more broadly, as we sought to develop resources that could work on their own without our support. However, we did observe that the teachers were learning the Key Concepts together with the children.

The idea for our ultimate approach—an illustrated story in comic book format, with an accompanying teacher’s guide—grew out of our efforts to find an approach that was feasible to implement despite many contextual constraints. We created and piloted several full drafts of this concept, before producing the final set of resources we used in the trial: comic book, exercise booklet, teachers’ guide, activity cards for one lesson, and poster (Informed Health Choices Group, n.d.-b).

Since the comic book represented a tightly scripted, narrative solution, teachers were able to conduct a lesson with very little or no prior experience teaching the content. Illustrations provided both visual appeal and support for low-literacy learners (Nicholas 2007). Translations of key vocabulary words to Luganda and Swahili, common local languages, helped facilitate teaching to students with lower English language competence. Classes read the comic book in



FIGURE 11.2
Informed Health Choices Primary School Learning Resources.

Source: For downloadable files in several languages: www.informedhealthchoices.org/primary-school-resources.

different ways than we had planned for. Some large classes read aloud in unison, some teachers assigned students to read the different characters' roles like a play, and others read aloud for the class or instructed students to read on their own. Students also brought books home and shared them with family members. To cover printing costs for resources needed in the randomized trial, we reallocated project funds.

What Did Evaluations Show?

What We Measured

To assess a person's understanding of and ability to apply the IHC Key Concepts (including children as young as ten), we developed the CLAIM Evaluation Tool multiple-choice questions (Austvoll-Dahlgren et al. 2017). Instead of a fixed questionnaire, CLAIM is a flexible battery of questions that can be combined according to the purpose (Informed Health Choices Group, n.d.-a). CLAIM questions can be used as tests in educational settings, in randomized trials evaluating outcomes of educational interventions, or in cross-sectional studies to gauge ability in a population. Prior to the trial, we validated the questions in a Rasch analysis in Uganda and Norway (Austvoll-Dahlgren et al. 2017). Researchers in other countries have since translated and validated CLAIM in several languages and settings.

For the school trial in Uganda, we used twenty-four multiple-choice questions that covered the twelve Key Concepts that were the starting point for the primary school resources (Nsangi et al. 2017) and nine Key Concepts covered in a podcast for parents that we developed and evaluated in parallel (Semakula et al. 2017). To measure understanding rather than memorization, the questions did not reuse any of the examples or scenarios in the learning resources. The test also included questions that assessed intended behaviors, self-efficacy, attitudes, and literacy.

In the trial, our primary outcome measurement was a mean score on the CLAIM test (comparing the mean score of the group who received the learning intervention to those who didn't). In addition, we wanted to look at what percentage of each group of students "passed" and what percentage achieved a mastery of the concepts. To determine these cut-off scores, we invited experts, teachers, and methodologists to make judgments in a structured approach for establishing standards for passing and mastery (Davies et al. 2017).

<p>Habibah has pain in her ear, and she asks her brother Hassan what to do about it. He says that once, when he had a pain like that, he rinsed his ear with hot water. The next day, his ear pain was gone. Based on his experience, he says rinsing with hot water is helpful for ear pain.</p>	<p>Do you agree with Hassan?</p> <p>A. Yes, because this is Hassan's experience, it is likely to be true.</p> <p>B. No, Hassan's experience is not enough to be sure.</p> <p>C. Yes, Hassan rinsed his ear with hot water, and the next day his ear pain was gone.</p>
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FIGURE 11.3
Example of CLAIM Multiple-Choice Question.

Source: To access, see: www.informedhealthchoices.org/claim-evaluation-tools.

End-of-Term Trial

We evaluated the primary school learning resources in 2016, in a cluster-randomized trial in Uganda, including 120 primary schools and over 10,000 ten- to twelve-year-olds (Nsangi et al. 2017). Intervention schools received the IHC primary school resources and an introductory workshop to explain the process of the trial. Teachers taught the content in nine, eighty-minute lessons during one school term. We did not intervene in the control schools.

Trial results showed that these learning resources led to a large improvement in the ability of students to assess claims about the effects of health interventions. Children's mean score in schools receiving the intervention was 20 percent higher than for the control schools (62.4 percent vs. 43.1 percent). Of the children in the intervention schools, 69 percent achieved a passing score compared to 27 percent in control schools, and 19 percent of children in intervention schools had a score indicating mastery of the twelve Key Concepts compared to 1 percent in the control schools. Teachers in intervention schools also performed considerably better than in control schools: 72 percent achieved a score indicating mastery compared to 15 percent in control schools.

TABLE 11.2
Results of End-of-Term Trial

<i>End-of-Term Trial</i>	<i>Control Schools</i> <i>N = 4,430 children</i> <i>67 teachers</i>	<i>Intervention Schools</i> <i>N = 5,753 children</i> <i>85 teachers</i>	<i>Adjusted Difference</i>
Mean score	43.1% (SD 15.2%)	62.4% (SD 18.8%)	20.0% (95% CI 17.3–22.7%)
Passing score, children (≥13 out of 24 correct answers)	27% (1,186 children)	69% (3,967 children)	50% (95% CI 44–55%)
Mastery score, children (≥20 out of 24 correct answers)	1% (38 children)	19% (1,070 children)	18% (95% CI 18–18%)
Mastery score, teachers (≥20 out of 24 correct answers)	15% (10 teachers)	72% (61 teachers)	57% (95% CI 37–70%)

One-Year Follow-Up Study

The one-year follow-up study indicated that learning is retained for at least a year (Nsangi et al. 2020). For the intervention schools, the mean score and the proportion of children with passing scores increased from the intervention term to the one-year follow-up term (mean score: from 62.4 percent to 68.7 percent, passing score: from 69 percent to 80 percent, and mastery score: from 18.6 percent to 28.9 percent). The mean scores in the control schools also improved from the previous year (from 43.1 percent to 53.0 percent), resulting in a somewhat smaller—albeit still large—difference between the intervention and control schools for the mean score. This means that all children improved their knowledge after one year, but the intervention school children maintained their lead over the children who hadn't received the IHC learning resources. Control schools received sets of learning resources after the study was completed.

TABLE 11.3
Results of One-Year Follow-Up

<i>One-Year Follow-Up</i>	<i>Control Schools</i> <i>N = 2,844 children</i> <i>64 teachers</i>	<i>Intervention Schools</i> <i>N = 3,943 children</i> <i>78 teachers</i>	<i>Adjusted Difference</i>
Mean score	53.0% (SD 16.8%)	68.7% (SD 18.2%)	16.7% (95% CI 13.9–19.5%)
Passing score, children (≥13 out of 24 correct answers)	51.5 % (1,464 children)	80.1% (3,160 children)	39.5% (95% CI 29.9–47.5%)
Mastery score, children (≥20 out of 24 correct answers)	4.9% (139 children)	28.9% (1,138 children)	25.0% (95% CI 23.2–26.5%)
Mastery score, teachers (≥20 out of 24 correct answers)	21.9% (14 teachers)	67.9% (53 teachers)	46.3% (95% CI 31.5–56.6%)

Process Evaluation

Our process evaluation study findings were consistent with the findings of the trial (Nsangi et al. 2019). The findings suggested that children, teachers, and parents valued the IHC school intervention and found the characters, story, and illustrations appealing. Teachers found the IHC lessons compatible with the curriculum and with their teaching styles. In addition, they appreciated the flexibility that enabled them to apply differentiated instruction. Effect modifiers included teachers' skills and competencies and positive learning environments. Our analysis concluded that these likely contributed to intermediate effects, including teachers' motivation, self-efficacy, positive attitudes, and a positive overall experience, which in turn contributed to the IHC resources having a large effect on the ability of the children to assess claims about treatment effects.

The process evaluation uncovered two major barriers to implementing the resources on a larger scale in Uganda. First, the cost of printing resources (4.00 USD per student) was prohibitive in this context. Second, despite the highly positive reception by participating schools, the content fell outside the current curriculum and was impossible to add to existing class timetables. In a new project to develop learning resources for secondary schools (2019–2024), we aim to mitigate these barriers by producing digital resources, by exploring how the IHC Key Concepts map onto existing curricula in participating countries, and by engaging earlier and more closely with curriculum developers (Informed Health Choices Group, n.d.-c).

Translation and Contextualization

Planning for and Facilitating Use in Other Settings

To ensure we didn't develop too narrowly targeted materials that were only suitable for use in Uganda, we translated the resources, carried out pilots in Rwanda, Kenya, and Norway, and incorporated findings from that work during development (Mugisha 2016; Ikirezi 2018). However, we did expect that there would be a need for additional adjustments to the content to make it suitable for use in other languages, cultural settings, and educational environments. Therefore, we developed detailed, pragmatic, open access guidance for translating and contextualizing the resources, with an emphasis on how to engage students, teachers, and other key stakeholders in this work (Informed Health Choices Group 2019a, 2017, 2019c). Our annual

newsletter provides an overview of all recent or ongoing activities in each IHC network country to adapt the IHC resources to their settings (Informed Healthcare Choices Group 2020).

Translation

The original resources are in English, with key words also provided in Luganda and Kiswahili. To date (autumn 2021) they have been translated to Spanish, Norwegian, Kinyarwanda, Kiswahili, French, Italian, Greek, Croatian, Basque, and Persian, with other languages in the pipeline.

Some languages may lack good translations for central vocabulary terms. When the Ugandan team translated the glossary to Luganda, they noted difficulties with words like *anecdote*, *chance*, and *unfair* (Semakula and Nsangi 2018). Additionally, many countries have more than one official language, and some have several local languages. We provided space in the textbook for the translation of key words for multi-language settings.

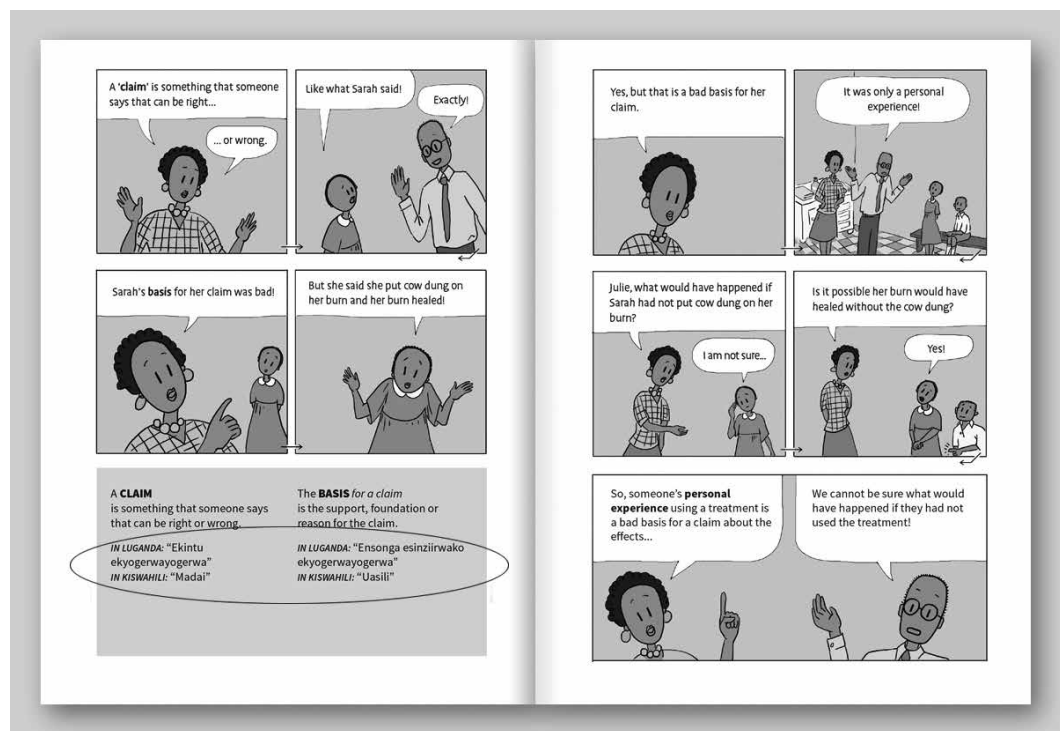


FIGURE 11.4
Space in the Layout for Translations of Key Terms to Other Locally Relevant Languages.

Other Contextualization

After language translation, other contextualization activities can include carrying out pilots in schools, changing or adapting content (texts or images), conducting context analyses, or validating the CLAIM Evaluation Tool. As of September 2021, two teams have written up contextualization results involving school pilots in settings other than East Africa: Ireland (Glynn 2020) and Italy (Alderighi, Rasoini, and Rosenbaum). Although we cannot draw firm

conclusions about contextualization concerns from the two studies, several patterns resonate with what we already know.

The Irish study was led by a school principal. The Italian study was carried out by two medical doctors who translated the resources and taught lessons to two classes at a local school. Both teams recruited school classes with children aged ten to twelve. For details, see the respective publications. These teams came to many similar conclusions about students' and teachers' personal experiences of the learning resources. The Irish study, however, also included stakeholder feedback from the wider educational environment, enabling the author to identify some of the most likely barriers to the uptake of the IHC learning resources in the Irish educational system.

Children's Experiences

Children in both countries responded enthusiastically to the learning resources, like the children in East Africa and Norway. They enjoyed the comic book characters and dialog, and felt the format made it more enjoyable and easier to learn. More importantly, they enjoyed learning the Key Concepts. The Italians reported that children especially liked learning about "bad basis for claims." The Irish and Italian children did not react negatively to the story being set in Africa; on the contrary, it appeared to add to their curiosity and interest in the material. Both teams also reported that children found the content easy to understand, that the structure helped children move confidently from simpler concepts to more difficult ones, and that the illustrated comic format appeared to facilitate motivation and widespread engagement.

Teachers' Experiences

Irish teachers who participated in teaching the lessons expressed positive experiences, with their confidence and enthusiasm growing as they progressed through the material. However, some experienced negative first impressions. Teachers and other stakeholders worried that students wouldn't relate to the African setting, which stood in contrast to the students' actual experiences; there was also initial concern about the number of pages in the book and guide, the prescriptive instructions, unfamiliar names and examples, and a seemingly simplistic vocabulary. Without adaptation to improve these first impressions and champions who could speak to the value of the program, the study concluded that the resources would not likely be implemented on a wide scale in Ireland, where there are many competing new programs for slots in an already full curriculum.

In the Italian study, teachers did not participate in teaching the lessons but had an observer role. They reported having positive experiences in terms of understandability, desirability, suitability, and usefulness.

Recommended Changes to the Learning Resources

Both the Irish and Italian teams left the drawings and storyline intact but made changes to the names of some of the characters in the comic. While the Irish changed many of the extra examples in the text to treatments and diseases that were more locally relevant, the Italian team left these mostly unaltered. However, they did provide more locally relevant examples orally while delivering the lessons (e.g., the local custom of taking onion as an antifu treatment). The Irish study recommended several physical changes to the children's book to counteract some

of the negative or misleading first impressions. This included altering the layout to fit the A4 format and eliminating the exercise and activity pages in the comic book to achieve a much thinner, less overwhelming publication and slimming the teachers' guide by deleting unnecessary content (such as the embedded comic book images). They also suggested the development of flashcards and other learning resources to form a toolbox for teachers that could facilitate more diversified, less prescriptive, teaching activities. Additionally, they proposed including more explicit home-school links that would tie in with the emphasis on parent involvement in the Irish curriculum.

Teacher Training Considerations

When developing these resources for use in Uganda, we understood that although the content would likely be new to most teachers, a comprehensive teacher training program would likely be unfeasible in most countries. Therefore, we deliberately created highly scripted content that teachers could use successfully without prior training. Although this prescriptive approach did effectively enable teachers in the Ugandan trial to conduct the lessons without extensive prior training, it wasn't obvious to those teachers that they would be able to do this until they had experience teaching the lessons. Additionally, the prescriptive approach was not appreciated by the Irish teachers and stakeholders, who were used to having more freedom to employ teaching strategies of their own choosing. The Irish study highlighted the necessity of teacher training, both to build teachers' confidence that the foreign-looking resources were actually very relevant to their students and to provide them with a better knowledge basis from which to bring their own ideas and teaching strategies into play.

The Italian team used a different approach: the two doctors taught the lessons, in the presence of the class teacher who both observed and provided classroom support. As medical professionals, the doctor team already had in-depth knowledge of the Key Concepts and understood the relevance of the content for the children. They were able to present relevant examples from the medical literature not included in the materials and improvise confidently during the lessons. It is also possible that the novelty of having doctors visit the class (mirroring the comic book narrative, where two doctors engage with two school children throughout the story) had an additional positive impact on students' curiosity and attention to the content. Although not likely as sustainable as national policy, this approach, with health professionals as guest teachers, could be adopted by individual regions or schools, or in more informal learning environments, such as library or community programs.

Relevance to Curricula

Interestingly, the Irish students did not recognize the IHC lessons as connected to curricular work, and they viewed this as an advantage. The Irish stakeholders identified Social Personal and Health Education (SPHE) as the subject most likely relevant for primary school learners and mentioned Social Environmental and Scientific Education (SESE) and English reading as other possibilities.

The Italian study did not include a formalized curriculum mapping, but the authors described subjects that teachers identified as relevant and how teachers applied the learning and approaches from these lessons in other classes. For example, teachers initiated a project involving a critical approach to advertisements and another where students created figurative representations of the Key Concepts.

In more recent projects, we have conducted context analyses that include mapping the IHC Key Concepts to national curricula to make these ties explicit for teachers and facilitate teaching the content in existing subjects (Lund 2018; Mugisha et al. 2021; Senyonga et al. 2021). However, the Key Concepts represent a new type of knowledge and skills that, while relevant to many different subjects taught today, will not likely map onto most existing subjects directly. Health may not be given much space in schools' timetables (e.g., thirty minutes a week in the Irish curriculum), and critical thinking is more likely to be an overarching goal in a curriculum rather than a separate subject.

However, educational systems are moving toward competence-based curricula (Voogt and Roblin 2012), with added emphasis on thematic and cross-cutting teaching. These resources are well-suited for that purpose. In the context analyses we have performed more recently in secondary schools, we found that newer curricula may include lofty ideals for teaching across subjects, but there is little information available about how teachers are supposed to do this, and few learning resources that are designed specifically for this purpose. These resources can fill some of that gap.

Conclusions

Health literacy, according to an integrated model, includes four types of competencies: the ability to access, understand, appraise, and apply health information (Sørensen et al. 2012). A systematic review of the causes, impacts, and potential strategies of the COVID-19 infodemic points to improving health literacy as an important countermeasure (Pian, Chi, and Ma 2021). Although the ability to appraise health information could be an important defense against misinformation, few studies have investigated the effects of interventions to teach critical appraisal skills to children, patients, or the public in any country. We have developed and evaluated learning resources for primary school children and their teachers that were shown in a large, randomized trial to have a substantial impact on children's ability to think critically about claims about the effects of health interventions and to use this knowledge in decision-making scenarios. Partnering teams are translating and contextualizing these resources for use in many countries. Building on this initial work, we are currently developing a new set of flexible, digital resources for use in secondary schools that we will evaluate in randomized trials and process evaluations in East Africa and subsequently make them available for translation and contextualization (see www.informedhealthchoices.org/secondary-school-resources).

Although these studies were carried out prior to the onset of pandemic, both teachers and children acknowledged the importance of learning to think critically about the effects of health interventions. Since then, the relevance of these learning resources has become much more apparent. Halpern and Dunn present critical thinking as a model for intelligence for solving real-world problems. They make a compelling argument for how improving people's critical thinking skills, such as the ability to think critically about the basis for a claim, could have had an important impact on attitudes and behaviors related to public health interventions during the pandemic (Halpern and Dunn 2021). It is our hope that curriculum developers, principles, teachers, parents, engaged health professionals, librarians, and others will use, adopt, and adapt the materials that we have created, so young people and adults are better positioned to protect themselves from misinformation about health interventions and make informed choices for themselves, their families, and their communities.

Free to Use and Adapt

The IHC primary school resources, other related resources, guides, and publications are accessible at www.informedhealthchoices.org. Learning resources are free to download, use, reproduce, or adapt. They are protected with a Creative Commons license 4.0 international license, meaning anyone can share as well as adapt the material, provided you credit us, indicate what changes you made, and do not use it for commercial purposes. Please contact us for access to files for translating, contextualizing, or high-resolution printing.

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