

Assessing potential "far transfer" of learning: protocol for development and evaluation of questionnaire items [Version 1, awaiting peer review]

Matt Oxman Working paper, August 2022

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Colophon

Title	Assessing potential "far transfer" of learning: protocol
	for development and evaluation of questionnaire items
	[Version 1, awaiting peer review]

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 Keywords Transfer of learning; Transfer; Far transfer; Education; Critical thinking; Critical appraisal; Health literacy; Critical health literacy; Evidence-based health care; Evidence-based medicine; Health; Public health; Students; Pupils; Learners; Secondary school students; High school students; Young people; Youth; Adolescents; School; Secondary school; High school; Educational interventions; Public health interventions; Teaching resources; Learning resources; Educational resources; Secondary school resources; High school resources; Low-income countries; LICs; Developing countries

- *Citation* Oxman, Matt. 2022. "Assessing potential 'far transfer' of learning: protocol for development and evaluation of questionnaire items [Version 1, awaiting peer review]." https://doi.org/10.5281/zenodo.6976925
 - Date August 2022

Abstract

Background

The value of a formal education is limited if people are unable to use or "transfer" what they learn in school to other contexts. However, there is uncertainty about how to achieve and evaluate transfer of learning, especially "far" transfer. Intended transfer of learning from an intervention is an intended increase in transfer outcomes attributed to the intervention in a randomised trial. To help assess potential far transfer of learning (far transfer effects) from an intervention intended to improve critical thinking about health choices—the Informed Health Choices (IHC) secondary school intervention—we are developing and evaluating (validating) questionnaire items (questions or tasks). In a separate, subsequent study, we will conduct a quantitative evaluation of the items. We will use the items developed in this study to measure outcomes in the 1-year-follow-up assessments of randomised trials of the IHC secondary school intervention in Kenya, Rwanda, and Uganda. In a separate, subsequent study, we will conduct a quantitative evaluation of the items.

Objectives

- 1. Identify intended transfer of learning (intended transfer effects, or increases in transfer outcomes) caused by the IHC secondary school intervention, by developing a model
- 2. Prioritise potential outcomes included in the model for the 1-year-follow-up assessments of the trials of the intervention
- 3. Develop and evaluate questionnaire items for measuring potential effects included in the model, focusing on the prioritised outcomes

Methods

The overarching steps of this study are 1) developing a model of potential transfer of learning from the intervention; 2) prioritising outcomes included in the model; 3) brainstorming and drafting questionnaire items; and 4) conducting a qualitative evaluation of the items.

Results

Results of the study will include:

- a model of intended transfer of learning (intended transfer effects, or increases in transfer outcomes) from the IHC secondary school intervention,
- a set of outcomes included in the model prioritised for the trials of the intervention, and
- measures of potential transfer of learning that have been qualitatively evaluated.

Discussion

An important limitation of the study is that any measure of skill developed will be intervention-inherent when used in the trials.

Background

The value of a formal education is limited if people are unable to use or "transfer" what they learn in school to other contexts. However, there is uncertainty about how to achieve and evaluate transfer of learning, especially "far" transfer [1,2]. Based on Barnett and Ceci's taxonomy for far transfer [1], we define "transfer [of learning]" as the application of knowledge or skills in a context that is different from the context in which the knowledge or skills were learned. The more different the transfer context is from the learning context, the "further" the transfer [1]. Besides general uncertainty about how to evaluate transfer of learning, there is specifically a lack of instruments for assessing the ability to think critically about health choices [3], including instruments that have been evaluated in low-income settings.

An effect of an intervention is an increase or decrease in an outcome attributed to the intervention, meaning intended transfer of learning from the intervention is an intended increase in transfer outcomes attributed to the intervention in a study. Researchers assess effects in randomised trials (comparisons between interventions) by measuring and comparing outcomes in the intervention and control arms.

To help assess potential far transfer of learning (far transfer effects) from an intervention intended to improve critical thinking about health choices —the Informed Health Choices (IHC) secondary school intervention—we are developing and evaluating (validating) questionnaire items (questions or tasks).We will use the items developed in this study to measure outcomes in the 1-year-follow-up assessments of randomised trials of the IHC secondary school intervention in Kenya, Rwanda, and Uganda [4–6].

Other researchers will be able to use our approach to developing and evaluating the items—if not the items themselves—to assess transfer of learning from other educational interventions, especially interventions intended to improve critical thinking in general or specifically about health choices. In a separate, subsequent study, we will conduct a quantitative evaluation of the items. In a parallel and corresponding study, we are developing and evaluating questionnaire items for assessing potential adverse effects of the intervention,

including transfer of mislearning, as well as misapplication of learning (mistransfer).

Objectives

- 1. Identify intended transfer of learning (intended transfer effects, or increases in transfer outcomes) caused by the IHC secondary school intervention, by developing a model
- 2. Prioritise potential outcomes included in the model for the 1-year-follow-up assessments of the trials of the intervention
- 3. Develop and evaluate questionnaire items for measuring potential effects included in the model, focusing on the prioritised outcomes

Methods

Figure 1 shows the overarching steps of the study, leading into a separate study in which we will quantitatively evaluate items developed in this study. We will consider changes to the draft questionnaire items during and after the qualitative evaluation. Where feasible, we will combine data collection for this study together with data collection for the development and evaluation of items for assessing potential adverse effects.

Figure 1. Overarching steps of the study.



The approach to this study is largely based on methods and findings from the development and evaluation of instruments (questionnaires) with sets of items from the Claim Evaluation Tools item bank [7,8]. We developed the Claim Evaluation Tools items and instruments to assess the primary outcome in the previous trial of the IHC primary school intervention [9], and the ongoing trials of the secondary school intervention [4–6].

The Claim Evaluation Tools items are multiple-choice and start with a scenario centred on a hypothetical health claim or choice.

Box **1** shows an example. Each Claim Evaluation Tools item measures the ability to apply a concept from the "Key Concepts for Informed Health Choices" framework, also known as the IHC Key Concepts [10]. The Claim Evaluation Tools items are measures of "near" transfer—i.e., the learning context (receiving the IHC secondary school intervention) and the transfer context (responding to the Claim Evaluation Tools items) are relatively similar. Importantly, in both contexts, the learner applies the concepts to hypothetical choices about what to believe or do, within health.

Peter often has a headache. A friend advises him to exercise. He says that people who exercise have fewer headaches than people who do not exercise. Based on this link between exercise and headaches, Peter's friend says that exercise will give him fewer headaches.

Question: Is Peter's friend right?

Options:

- A) It is not possible to say. There might be other differences between people who exercise and people who do not
- **B)** It is not possible to say without knowing how much people exercised
- C) Yes, because exercise must help if people who exercise have fewer headaches than people who do not



We will store anonymous qualitative data on the server provided and managed by the Norwegian Health Network for the Norwegian Institute of Public Health. We will not store the names of participants or schools, or any sensitive data. When we record interviews, we will only record audio. We will transcribe each recording, then delete it. We will store the recordings and quantitative data locally, in each country.

Development of a model: Identification of potential far transfer

To be able to prioritise outcomes and develop discrete measures, we must first identify potential far transfer that seem logical and likely to be important. To identify and distinguish such effects, we will develop a model. The model will include skills that recipients of the intervention might learn from the intervention, and contexts to which they might transfer those skills. The different combinations of skills and contexts represent different potential transfer effects.

Our starting points for the model are:

- the latest version of the "Key Concepts for Informed Health Choices" framework [10],
- the cross-field (interdisciplinary) "Key concepts for making informed choices framework" [11],
- Barnett and Ceci's taxonomy for far transfer [1],
- findings from the trial of the IHC primary school intervention [9], and
- findings from the process evaluation for that trial [12].

Prioritisation of outcomes: Group interviews with students and teachers

To help prioritise outcomes included in the model, we will interview groups of students and teachers, respectively, from the intervention arms of the trials. We will explore whether they have experienced or observed potential transfer of learning from the intervention, as well as what transfer of learning they generally consider most likely and important. If time, we will also explore if they have ideas for the content or format of draft measures (see "Brainstorming and drafting items" below). Appendixes 1 and 2 are the initial interview guides.

To start, we will interview one group of students and one group of teachers in each of Kenya, Rwanda, and Uganda. We will consider whether additional interviews are worthwhile and feasible. We will also consider interviewing other stakeholders, such as parents, curriculum developers, or teachers at schools in the intervention arms who did not participate in the trials but teach students who received the intervention.

We will end the interviews after 1.5 hours maximum. We will aim for groups of 5 participants, allowing for data on a diversity of experiences and views to be collected at once, but also adequate time for each participant to speak. We have chosen group rather than individual interviews for several reasons. Generally, group interviews are more efficient in terms of capturing diversity, and participants can build on each other's responses. Furthermore, based on previous experience and findings—including the process evaluation for the trial of the IHC primary school intervention [12]—we expect participants will easily understand the topic and engage in the discussion, i.e., we do not expect to spend much time explaining questions. However, if group interviews are infeasible for practical reasons, we will conduct individual interviews instead, lasting 1 hour maximum.

We will conduct a thematic analysis [13] of the collated data from all the interviews, including the following steps:

- 1. Pilot a spreadsheet for tagging the data
- 2. Review and tag each data point with an initial theme
- 3. Compare and harmonise tags and themes
- 4. Organise the data by theme, in a document
- 5. For each theme, suggest implications for the prioritisation
- 6. Compare suggestions and agree on implications

Two members of the research team will complete each step. If and where the two are unable to harmonise judgements or agree on implications, a third team member will arbitrate.

Brainstorming and drafting items

We will brainstorm and draft items for each prioritised outcome. We will draft ≥4 items for each outcome, so we can potentially remove items that we find are problematic without having to replace them. We will then decide whether to brainstorm and draft additional items for the non-prioritised outcomes in the framework. This decision will depend on practical considerations, including the number and complexity of the remaining outcomes, as well as time and resources.

Qualitative evaluation of items

Survey of experts

To evaluate the degree to which the items are sufficiently complete and sensible measures of the outcomes of interest—i.e., test face or content validity [14], or sensibility [15]—we will survey researchers and others with relevant expertise, including members of our international advisory network [16]. We will develop the survey after drafting the items, using Nettskjema, an online survey tool developed and hosted by the University of Oslo [17]. We will ask the experts to evaluate both the content and format of the items, including understandability, relevance, and acceptability of terminology, examples, and instructions.

We will conduct a thematic analysis [13] of the collated survey data. The steps of the analysis will correspond with those listed under "Prioritisation of outcomes: Group interviews with students and teachers", above. However, in this analysis, we will tag each data point with the relevant outcomes and draft items, rather than themes. In the last step, we will decide whether to retain, revise, remove, or replace each item.

Individual interviews with students

To further evaluate the degree to which the items are sufficiently complete and sensible, we will interview individual students. We will ask each participant to "think aloud" as they respond to the questions or tasks, before asking them about the items. We will develop the interview guide after addressing the survey findings. Like in the survey, we will include items in the interview guide about both the content and format of the items.

We will only include students who are unfamiliar with the intervention since we want respondents in the control arms of the trials to understand the items despite their unfamiliarity. In other words, we will exclude participants in the development of the intervention or in the intervention arms of the trials. We will interview at least 5 students in each country.

We will consider changes to the items after every interview, based on the latest data. We will do a final, thematic analysis [13] of the collated data from all the interviews, taking the same steps as in the analysis of the survey data.

Pilots of questionnaire

We will pilot the remaining items together, as an instrument. To start, we will include two classes of students in each country—one class that is familiar with the intervention, and one that is not. We will use the data from students to estimate the potential power of the instrument to detect differences between students in the intervention and control arms of the trials.

We will record the total time it takes each participant to respond to all items. These results will help inform whether to include the final items in the questionnaire used for the primary outcome in the trials—the "Critical Thinking about Health Test" [4–6]—or administer them as a separate instrument to subgroups of the trial participants. Furthermore, we will inspect the responses visually, to evaluate whether participants understood the instructions and format of the items. Where visual inspection suggests there might be a problem with instructions or format, we will consider and agree on any changes to address the problem.

Quantitative evaluation of items

In a separate, subsequent study, we will evaluate the psychometric properties of the items. If feasible, we will complete this quantitative evaluation and address problems that it reveals (i.e., revise, remove, or replace items) before the 1year-follow-up assessments of the trials. If a quantitative evaluation is not feasible before the 1-year-follow-up assessment, we will use data from that assessment to evaluate the items and report any problems. There are different quantitative tests of validity [14]. The appropriate test or tests that we use will depend on the final format and content of the items.

Results

Results of the study will include:

- a model of intended transfer of learning (intended transfer effects, or increases in transfer outcomes) from the IHC secondary school intervention,
- a set of outcomes included in the model prioritised for the trials of the intervention, and
- measures of potential transfer of learning that have been qualitatively evaluated.

Discussion

Strengths

Overall, we will be taking a systematic, iterative, and transparent approach to assessing potential transfer of learning.

Limitations

Any measure of skill developed in this study will be intervention-inherent when used in the trials. This means it will be a measure of a skill that is only actively taught in the intervention arms, given that critical thinking about health or in general is rarely taught in secondary schools in Kenya, Rwanda, or Uganda [4–6].

As is logical, intervention-inherent ("treatment-inherent") measures are associated with larger effect sizes than intervention-independent measures, in education research [18]. In other words, it is possible that in the trials, we will find large effects on skills evaluated using the items developed in this study mostly because the skills are actively taught in the intervention arms and not the control arms, i.e., not because the intervention is particularly effective.

We will address this and any other methodological limitations by being transparent and cautious when reporting and interpreting the results of this study, as well as relevant results of the trials. Moreover, we will contrast the trial findings with in-depth, qualitative findings from this study and the process evaluations.

Ethics

Participation in this study is voluntary and does not involve likely or serious risks to participants. The survey will include a description of how we will manage and use the survey data. Because responses to the survey will be anonymous, we will not seek written consent from respondents. Rather, we will include a statement that responding implies consent. For the interviews, we will seek written ascent and consent, unless the participant has already provided necessary ascent or consent for the entire evaluation stage. We will obtain, or confirm that we have obtained, separate ascent and consent to being audio-recorded.

The Norwegian Institute of health is the project's lead partner. As required by the institute—to comply with the European General Data Protection Regulation—we have completed a data privacy impact assessments (DPIAs) for the entire evaluation stage of the project, including this study. The Data Protection and Chief Information Security Officers at the institute provided feedback on the DPIAs, and the relevant senior advisor at approved them. Furthermore, as required by the funder, the Research Council of Norway, we have created a data management plan for the entire project, which we are updating continuously and will submit to the council at the end of the project. Since the project will not generate new knowledge about health and disease, it falls outside the remit of the Regional Committee for Medical Research Ethics [19], in Norway, which the committee has confirmed.

In Kenya, we will obtain ethics approval from Masinde Muliro University of Science and Technology Institutional Ethics Review Committee and the Kenya National Commission of Science and Technology Institute, as well as approval from the Ministry of Education and the Teachers Service Commission, nationally and at the county-level. In Rwanda, we will obtain ethics approval from the Rwandan National Ethics Committee. In Uganda, we will obtain ethics approval from the School of Medicine research ethics committee at the Makerere University College of Health Sciences, and from the Uganda National Council for Science and Technology.

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Appendix 1. Guide for interviews with students.

Pre-interview

Table 1. Data about interview.

Date	Country	Interviewer	Notetaker(s)	Setting

Table 2. School data.

Location	Funding	Other relevant data about
Urban; semi-urban;	Private; public;	school
semi-rural; rural	other (specify)	

Part 1: Practicalities

- Introduce interviewer and notetaker(s).
- Introduce the topic, goal, and structure of the interview:
- We would like to interview you for a study.
- The topic of the interview and the study is using anything you have learned from the "Be Smart about Your Health" lessons.
- The goal of the interview is to learn from your experiences.
- We will share what we learned with others, mainly researchers, in an article about the study.
- The interview will last for maximum 1.5 hours. 🗌
- We can take a break whenever you want. 🗌
- We will start the interview by providing a little more information about the topic and goal.
- Then we will ask a few questions about you.
- Then we will ask about using anything you have learned. 🗌
- If time, we will also ask you how to measure whether other students have used anything they learned.
- Emphasise:
- The goal is not to test you, and there are no wrong answers. \Box

- If anything is unclear, please let us know, so we can explain better.
- And please let us know if you would like any information in another language.
- We will not share your real names or the name of your school, in the article or anywhere else.
- It will not be possible to identify you by reading the article.
- We would like to audio-record the interview. 🗌
- We will use the recording to write what you said, so we do not misunderstand or overlook anything.
- We will delete the recording when we are finished writing what you said.
- We will not share the recording with anyone else. 🗌
- You can leave the interview at any time, without giving any reason.
- Unless we have already published the article, you can ask us to delete what you have shared with us, without giving any reason, and we will delete it.
- Take questions.
- If obtaining ascent, review content of ascent form, and take questions.
- Confirm previous ascent or obtain written ascent to participation and recording, respectively.
- Ask participants to choose aliases and write them on name tags or place cards.
- Start recording.

Part 2: Explanation of topic and goal.

- The topic of this interview is using anything you have learned from the "Be Smart about Your Health" lessons.
- Our goal is to learn from your experiences.
- This will help us when we develop written questions or tasks for measuring whether students have used anything they learned from the lessons.
- And it can help us develop better teaching and learning resources.
- It might also be helpful to others, mainly other researchers.
- "Using what you learned" means learning a fact or skill, then using it later, in some other situation.
- Researchers sometimes call this "transfer of learning" or just "transfer". 🗌
- When someone learns something in a lesson at school, they might use it later in a different subject, or outside of school, in daily life.
- For example, when someone learns certain skills in mathematics lessons, they might use those skills later in physics or biology lessons.

- Probably, you have used skills you learned in mathematics lessons in daily life—can you give an example?
- Example, if necessary: Using addition and subtraction when shopping or making budgets.
- Using what we learn in school is very important.
- However, it is sometimes difficult to learn or use something.
- It can also be difficult to know whether people have used anything they learned.
- That is why we are interviewing you, as well as other students and teachers, about the topic.
- Take questions.

Part 3: Participant background

- We want to know a little about the students we interview.
- This will help us when we consider how similar or different your experiences might be compared to those of other students, who we do not interview.

1: *Please answer a few questions about yourselves:*

- What are your ages? 🗌
- What forms are you in?
- What are your favourite subjects at school?
- What are your least-favourite subjects?

Alias	Age	Gender	Form	Favourite subject	Least-favourite subject

Table 3. Participant data. 🗌

Part 4: Experiences and observations of transfer

2: If you learned any skills from the lessons, can you give any examples?

- Clarify, if necessary:
- If you did not learn anything from the "Be Smart about your Health" lessons, or use anything you learned, that is fine and helpful for us to know.

3: Thinking about any skills that you learned, which of those skills do you think are most important?

4: If you used anything you learned, can you give any examples?

- Prompts:
 - Other lessons/subjects □
 - Tests/exams
 - Daily life: home, shops/market, clinic/hospital, other

5: If you have seen other students using something they learned from the lessons, can you give any examples of this?

6: If there are skills that you think most students can learn from the lessons, and use, what are those skills?

Part 5: Measuring transfer

- Interviewing many students like this would take a lot of time. 🗌
- Therefore, we are trying to develop some written questions or tasks to measure how many students have learned and used different skills from the "Be Smart about your Health" lessons.

7: If you were to write questions or tasks, to find out whether another student has used anything they learned from the lessons, what might those questions or tasks be like?

- For the questions and tasks, we need examples that are familiar and relevant to most students.
- We need to use simple language, so any student can understand them. 🗌

8: What are some examples that you think might be familiar to most students, even if they have not completed the lessons?

- Prompts:
 - Health actions □
 - Illnesses or injuries □
 - \circ Health claims
 - Health choices
 - \circ Other types of actions, besides health actions
 - \circ Choices about other actions

9: What words used in the lessons do you think might be especially difficult for students who have not completed the lessons?

Part 6: Conclusion

10: Allow notetaker to ask questions and comment.

11: *Is there anything that we could have done differently, to improve your experience of this interview?*

- Prompts:
 - Information about the interview
 - Explanation of the topic or goal
 - Questions

- Terminology
 Examples

12: Do you have any other comments or questions?

• Thank participant and stop recording.

Appendix 2. Guide for interviews with teachers.

Pre-interview

Table 2. Data about interview.

Date	Country	Interviewer	Notetaker(s)	Setting

Table 2. School data.

Participant alias	Location Urban; semi-urban; semi-rural; rural	Funding Private; public; other (specify)	Other relevant data about school

Part 1: Practicalities

- Introduce interviewer and notetaker(s).
- Introduce the topic, goal, and structure of the interview:
- We would like to interview you for a study. 🗌
- The topic of the interview is students using anything they have learned from the "Be Smart about Your Health" lessons.
- The goal of the interview is to learn from your experiences.
- We will share what we learned with others, mainly researchers, in an article about the study.
- The interview will last for maximum 1.5 hours.
- We can take a break whenever you want. 🗌

- We will start the interview by providing a little more information about the topic and goal.
- Then we will ask a few questions about you. 🗌
- Then we will ask about students using anything they have learned.
- If time, we will also ask you about how to measure whether students have used anything they learned.
- Emphasise:
- The goal is not to test you, and there are no wrong answers.
- If anything is unclear, please let us know, so we can explain better. 🗌
- And please let us know if you would like any information in another language.
- We will not share your real names or the names of your schools, in the article or anywhere else.

- It will not be possible to identify you by reading the article. \Box

- We would like to audio-record the interview. \Box
- We will use the recording to write what you said, so we do not misunderstand or overlook anything.
- We will delete the recording when we are finished writing what you said. \Box
- We will not share the recording with anyone else. \Box
- You can leave the interview at any time, without giving any reason.
- Unless we have already published the article, you can ask us to delete what you have shared with us, without giving any reason, and we will delete it.
- Take questions.
- If obtaining consent, review content of consent form, and take questions.
- Confirm previous consent, or obtain written consent to participation and recording, respectively.
- Ask participants to choose aliases and write them on name tags or place cards.
- Start recording.

Part 2: Explanation of topic and goal.

- The topic of this interview is students using anything they have learned from the "Be Smart about Your Health" lessons.
- Our goal is to learn from your experiences. 🗌
- This will help us when we develop written questions or tasks for measuring whether students have used anything they learned from the lessons.
- And it can help us develop better teaching and learning resources.
- It might also be helpful to others, mainly other researchers. 🗌
- "Using what you learned" means learning a fact or skill, then using it later, in some other situation.
- Researchers sometimes call this "transfer of learning" or just "transfer". 🗌
- When someone learns something in a lesson at school, they might use it later in a different subject, or outside of school, in daily life.
- For example, when someone learns certain skills in mathematics lessons, they might use those skills later in physics or biology lessons.
- Probably, most people have used skills you learned in mathematics lessons in daily life, for example when shopping or making budgets.
- Using what we learn in school is very important.
- However, it is sometimes difficult to learn or use something. 🗌
- It can also be difficult to know whether people have used anything they learned.
- That is why we are interviewing you, as well as other teachers and students, about the topic.
- Take questions.

Part 3: Participant background

- We want to know a little about the teachers we interview. 🗌
- This will help us when we consider how similar or different your experiences might be compared to those of other teachers, who we do not interview.

1: *Please answer a few questions about yourselves:*

- How many years have you worked as a teacher?
- What forms do you teach? 🗌
- What subjects do you teach? 🗌

Table 3. Participant data.

Alias	Gender	Years of teaching experience	Forms	Subjects

Part 4: Experiences and observations of transfer

2: If you observed students learning any skills from the lessons, can you give any examples?

- Clarify, if necessary:
- If you did not observe your students learning anything from the "Be Smart about your Health" lessons, or using anything they learned, that is fine and helpful for us to know.

3: Thinking about any skills that they learned, which of those skills do you think are most important?

4: If you observed them using anything they learned, can you give any examples?

• Prompts:

- \circ Other lessons/subjects
- Tests/exams
- Daily life: home, shops/market, clinic/hospital, pharmacy, other

5: If there are skills that you think most students can learn from the lessons, and use, what are those skills?

Part 5: Measuring transfer

- Skip this part of if short on time.
- Interviewing many students would take a lot of time.
- Therefore, we are trying to develop some written questions or tasks to measure how many students have learned and used different skills from the "Be Smart about your Health" lessons.

6: If you were to write questions or tasks, to find out whether a student has used anything they learned from the lessons, what might those questions or tasks be like?

- For the questions and tasks, we need examples that are familiar and relevant to most students.
- We need to use simple language, so any student can understand them. \Box

7: What are some examples that you think might be familiar to most students, even if they have not completed the lessons?

- Prompts:
 - Health actions □
 - Illnesses or injuries □
 - Health claims □
 - Health choices
 - \circ Other types of actions, besides health actions
 - Choices about other types of actions.

8: What words used in the lessons do you think might be especially difficult for students who have not completed the lessons?

Part 6: Conclusion

9: Allow notetaker to ask questions and comment.

10: *Is there anything that we could have done differently, to improve your experience of this interview?*

- Prompts:
 - \circ Information about the interview \Box
 - Explanation of the topic or goal
 - Questions
 - Terminology □
 - Examples

11: Do you have any other comments or questions?

• Thank participant and stop recording.