

Validation of educational materials for an online course aimed at promoting water consumption among middle-school adolescents in Mexico

Validación de materiales educativos de un curso en línea para promover el consumo de agua en adolescentes de nivel secundaria en México

Araceli Apolonia Salazar-Coronel^a, Alejandra Jiménez-Aguilar^a, Rebeca Uribe-Carvajal^a, Graciela Berenice Chávez-Becerril^a, Ana Karen Pérez-Jiménez^a, Teresa Shamah-Levy^a

^a Centro de Investigación en Evaluación y Encuestas, Instituto Nacional de Salud Pública, México

Abstract

Introduction: Validating health-education materials prevents the dissemination of erroneous messages and enhances the effectiveness of health-promotion initiatives. **Objective:** To describe the validation process for five educational materials pertaining to an online course on the promotion of water consumption among Mexican adolescents. **Methodology:** One group of 13-15 experts (technical validation) and another of 13-39 adolescents (population validation) reviewed three infographs and two videos using digital tools. Five criteria were established for the evaluation: appeal, clarity, identification, acceptance and inducement to action. A performance index was developed based on two categories: strong or weak compliance with each criterion. Successful compliance was determined when 70% or more of responses fell within the strong-compliance category. **Results:** Between 80% and 100% of the experts and adolescents rated all materials in the strong-compliance category for appeal, acceptance, clarity and inducement to action. For identification, however, the experts accorded the three infographs low scores, with similar results obtained from the adolescents for the three infographs and one video. **Conclusions:** Validation of the course materials allowed for identifying their strengths and weaknesses, as well as for ascertaining their usefulness in promoting water consumption among Mexican adolescents.

Keywords: validation studies; educational and outreach materials; drinking; adolescents; Mexico.

Resumen

Introducción: La validación de material educativo en salud podría evitar comunicar mensajes erróneos y mejorar su efectividad en promoción de la salud. **Objetivo:** Describir el proceso de validación de cinco materiales educativos de un curso en línea sobre promoción del consumo de agua entre adolescentes mexicanos. **Metodología:** Un grupo de 13-15 expertos (validación técnica) y un grupo de 13-39 adolescentes (validación poblacional) revisaron tres infografías y dos videos utilizando herramientas digitales según cinco criterios: atractivo, claridad, identificación, aceptación e inducción a la acción. Desarrollamos un índice de dos categorías: alto o bajo cumplimiento por criterio. Se determinó un cumplimiento exitoso cuando el 70% o más de las respuestas se concentraron en alto cumplimiento. **Resultados:** Entre el 80% y el 100% de los expertos y adolescentes calificaron todos los materiales con alto cumplimiento según atractivo, aceptación, claridad e inducción a la acción. El criterio de identificación según los expertos tuvo un bajo porcentaje de alto cumplimiento en las tres infografías. Se observaron resultados similares según los adolescentes para las tres infografías y un video. **Conclusiones:** La validación de los materiales permitió identificar sus fortalezas y áreas de mejora, y conocer su utilidad en promover el consumo de agua entre adolescentes mexicanos.

Palabras clave: estudios de validación; materiales educativos y de divulgación; bebidas; adolescentes; México.

Introduction

Validating materials for educational purposes constitutes a technical and social process that serves to assess the reactions of a given audience to messages. It not only appraises the cognitive and emotional reactions to the content and design of the messages, but also explores the feasibility of their modifying specific behaviors (Ziemendorff & Krause, 2003).

Numerous educational materials have been developed with the aim of preventing over-weight and obesity (OO) (Štefanc & Mažgon, 2012). Many of these, widely distributed and utilized without prior validation, communicate erroneous messages and propose actions that are only minimally relevant to the contexts of the audiences addressed, thus hindering the achievement of the very objectives they are pursuing (Franco-Aguilar et al., 2018).

In an effort to curb the high prevalence of OO among adolescents (Shamah-Levy et al., 2018a), Mexico developed a gender-specific multilevel strategy named Schools Promoting Water Consumption (EPCA). This initiative flowed from a situational diagnosis conducted during the 2018-2019 school year across the public middle schools participating in the National Program of Water Drinkers at School (PNBE). This program, recently canceled, was a countrywide effort to encourage free water consumption in schools. The re-sults of the diagnosis have been described elsewhere (Jiménez-Aguilar, et al., 2021). Briefly, they revealed that a high proportion of adolescents consumed sugary drinks and an equally high proportion did not utilize the water fountains in their schools; this behavior was observed predominantly among female students, and particularly during morning classes ($p < 0.05$). Among other activities, EPCA offers an online course for adolescents named "I choose, drink and promote the consumption of water!" (Jiménez-Aguilar et al., 2021). This course employs educational materials including infographs and videos to disseminate messages on water consumption and the use of water fountains at school. The contents of the course were developed according to six Social Cognitive Theory (SCT) constructs: behavioral capacity, outcome expectations, self-efficacy, observational learning, reciprocal determinism and reinforcement (Bandura & Walters, 1977).

In light of the above, and with a view to promoting effective messages through innovative pedagogical methods, we validated and then described the validation process for the educational materials of the EPCA online course.

Methods

Design

Using a survey-centered design and quantitative cross-sectional methodology, we conducted technical and population validations of the course materials. The first

comprised an expert review and the second a review by adolescents with characteristics similar to those of the population of interest as regards age, sex and current school year (Fondo de las Naciones Unidas para la Infancia, 2003; Rabeh et al., 2012; Organización Panamericana de la Salud, 1998).

Validation materials

Agua vs. Bebidas azucaradas

¿Sabías que el agua es la mejor bebida que puedes elegir?

- Regula la temperatura del cuerpo
- Disminuye la fatiga
- Mejora la digestión
- Ayuda al buen funcionamiento de los músculos
- Mantiene la piel hidratada
- Mejora la concentración
- Ayuda a mantener un peso saludable

En cambio...
¿Sabías que, en promedio, las chicas y los chicos de tu edad consumen dos vasos y medio (500ml) de refresco al día, y que con cada vaso de refresco casi duplican sus probabilidades de sufrir obesidad?

Además del aumento de peso, el consumo de bebidas azucaradas provoca:

- Dificultad para dormir
- Sentimientos de tristeza y enojo
- Caries
- Enfermedades del corazón y diabetes

¿Cuánta agua debes tomar cada día?

Para saber cuánta agua debes tomar cada día, es decir, cuánta agua regular, es importante que consideres tus propias características, tales como:

- Edad
- Peso
- Estatura
- Sexo
- Duración e intensidad de la actividad física que realizas
- Temperatura del ambiente (clima) donde estás

Sin embargo, para conocer rápidamente cuánta agua debes de tomar cada día, puedes revisar la recomendación de acuerdo con tu edad y sexo.

Las recomendaciones están hechas por expertas y expertos que consideran promedios de peso y estatura para mujeres y hombres de diferentes edades, además de condiciones estándares de Temperatura ambiente y niveles de actividad física. La siguiente tabla presenta recomendaciones de consumo de agua para chicos y chicas de tu edad.

Recomendación de consumo de agua de acuerdo con la edad y el sexo		
Edad	Recomendación	
Adolescentes	Hombres	Mujeres
4-13 años	2.1 Litros/día	1.5 Litros/día
14-18 años	2.5 Litros/día	2.0 Litros/día

Recomendación ajustada para condiciones moderadas de temperatura ambiente y actividad física.
Fuente: European Food Safety Authority (EFSA) Food and Dietary Products, Nutrition and Allergies Group. <https://www.efsa.europa.eu/en/dietary-references-values>.
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Infograph 1. Water vs. Sugary Drinks: this material illustrates the health benefits of con-suming water as well as the health risks of consuming sugary drinks, and presents consumption recommendations according to age and sex.

Botellas rellenables vs. Botellas desechables

¿Sabías que...?

1 min. 1 millón de botellas 20%

Cada minuto, alrededor del mundo, se compra 1 millón de botellas y esta cantidad aumentará un 20 % para el año 2021, lo cual ocasionará una crisis tan grave como el cambio climático.

¿Y qué pasó con el resto de las botellas?

SEMARNAT 2017 90 millones

La Comisión de Medio Ambiente y Recursos Naturales reportó que, en el año 2017, en México se lanzaron 90 millones de botellas de PET a las vías públicas, carreteras, bosques, playas, ríos y mares.

El PET no es degradable y puede tardar aproximadamente 500 años en descomponerse, lo cual ocasiona su acumulación y contribuye al calentamiento global.

Además, ¿sabes cuánto gastas en agua embotellada?

En promedio, una botella de un litro te cuesta \$10.00, por tanto, si compras una al día, al final del año habrás gastado \$3,650.00

\$10.00 x 365 = \$3,650.00

La siguiente tabla de costos te ofrece una mejor idea del dinero que puedes estar gastando solamente en botellas de agua.

Marca	Costo al día	Costo a la semana	Costo al mes	Costo al año
Ciel (1 Litro)	\$11.90	\$83.30	\$357.00	\$4,343.50
Bonafont (1 Litro)	\$6.70	\$46.90	\$201.00	\$2,415.50

¿Qué puedes hacer para evitar los problemas de utilizar botellas desechables?

Una buena opción es tener una botella rellenable con agua siempre cerca de ti, ya que obtendrás beneficios:



- Ecológicas**
Tener una botella reutilizable para beber agua te permite ayudar al planeta, pues no generas basura.
- Económicas**
Tener una botella reutilizable para beber agua te permite ahorrar dinero, pues en lugar de comprar agua en botellas de PET desechables, solamente llenas tu botella, la rellenas y la vuelves a utilizar.
- Salud**
Tener una botella reutilizable te permite tomar agua en todo momento, lo que te ayuda a mantener un peso saludable y a mejorar tu concentración para sacar buenas calificaciones.

¡IMPORTANTE!

La Organización Mundial de la Salud (OMS) no recomienda utilizar botellas desechables de plástico con bisfenol A (BPA) para transportar líquidos, ya que pueden ocasionar diabetes, obesidad, cáncer de mama y próstata, infertilidad y daño cerebral.

Por este motivo, la OMS recomienda elegir materiales como:

Acero inoxidable, vidrio, silicona y plástico sin BPA (bisfenol A), ya que, aun reutilizándolos, no pierden sus propiedades y no generan daños a la salud.

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Mis bebederos

¿Cuáles son los beneficios de tener bebederos en mi escuela?

El principal beneficio de los bebederos escolares es tener acceso a agua potable gratuita y de forma permanente en la escuela.

Tomar agua de los bebederos escolares te ayuda:



A consumir menos bebidas azucaradas y, con ello, a mantener un peso saludable y a prevenir enfermedades graves como diabetes tipo 2.



A estar hidratado y, con ello, a mejorar tu concentración para tener mejores calificaciones y para rendir en todas tus actividades.



A ahorrar dinero al no tener que comprar agua embotellada ni bebidas azucaradas y, con ello, a disminuir la contaminación por el uso y desecho de botellas de plástico desechables (PET).

¿Cuáles son los componentes de los bebederos de mi escuela?



- 1 Toma de la red de agua potable estatal o municipal.
- 2 Envoltente y cubierta que protegen los bebederos y los componentes de su sistema.
- 3 Tinaco de uso exclusivo para los bebederos, con sus prefiltros, los cuales evitan la contaminación del agua.
- 4 Filtros de potabilización que mantienen limpia el agua para su consumo.
- 5 Válvulas para controlar el paso del agua a través de las boquillas.
- 6 Boquillas y dispositivo para el llenado de botellas

¿Cómo funcionan los bebederos de mi escuela?



- El agua de la red municipal o estatal pasa a través del prefiltro, lo que garantiza que esté limpia.
- La bomba lleva el agua a los filtros de potabilización, donde se eliminan contaminantes y microorganismos.
- Finalmente, el agua del bebedero está lista para su consumo.

¿Quieres conocer más sobre los bebederos escolares?

Consulta la página web de INIFED:

<https://www.inifed.gob.mx/bebederosescolares/10-casos-que-necesitas-saber/>

Conoce los tratamientos para la potabilización del agua en:

<https://www.youtube.com/watch?v=MyYLLG8Wtc>

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Infograph 2. Refillable Bottles vs. Disposable Bottles: this material presents the benefits of using the first and the risks of using the second type of bottles for health and the planet.

Infograph 3. My Water Fountains: these images illustrate the benefits of having water fountains at school and present the function that the fountain system fulfills.

Video 1. Personalize your refillable bottle and carry it with you. This tutorial provides adolescents with instructions for decorating their water bottles and making bottle holders. It is available online at <https://www.youtube.com/watch?v=fnloOM9iBrA>.

Video 2. How to use my water fountains properly. This video offers instructions for adolescents on the optimal way to use and care for school fountains. It is available online at <https://www.youtube.com/watch?v=Sw5LgJFJoK4>.

Population

We recruited the experts and adolescents by convenience. A directory was set up for each group including general data and e-mail addresses for potential participants living/working close to the offices of the research team. The directory for the expert group contained data on 15 specialists in different areas (communication, medicine, nursing, nutrition, pedagogy and psychology); the one for the adolescent group included data on 18 female and male youths between the ages of 11 and 15. Invitations to participate in the study were sent to the members of both groups by email. To recruit adolescents, we initially approached their mothers, fathers or guardians. The youths who agreed to participate were also asked to invite friends their age to the validation process. The research team invited additional adolescents using their own social networks.

Data collection instruments and procedures

We created 10 self-administered digital questionnaires – five per group of participants– using the Google Forms web-based application (Google Forms, 2020). Each questionnaire dealt with a specific educational material:

three infographs and two tutorial videos, and contained between 18 and 22 closed and open-ended items; the former were designed as dichotomous Likert-type questions.

Each questionnaire explored five validation criteria, as classified by Ziemendorff & Krause (Ziemendorff & Krause, 2003): (1) appeal: the images, colors, font, music and other sensory aspects of the material are capable of attracting the intended public; (2) clarity: the meanings of the words and other contents can easily be understood by the audience addressed, and the number of ideas is appropriate; (3) identification: the material reflects the characteristics of the population of interest; (4) acceptance: the various components of the material are likely to be approved by the audience; and (5) inducement to action: the material is capable of motivating the audience to perform the actions being promoted.

Both groups of participants received the materials and questionnaires, in sequence, via e-mail WhatsApp and Facebook, and were allowed 8-15 days to evaluate each one. Table 1 describes the characteristics of each questionnaire. The questions for experts explored whether every topic was comprehensible and useful for promoting healthy behaviors. They probed how participants perceived the information, colors, images and fonts in the materials and whether they liked or disliked them. They also provided a space for respondents to suggest ways of improving their design and contents. The questions for adolescents were similar to those formulated for the experts, the only difference being that the latter were asked what they thought regarding the clarity of the message and the likelihood that it would move adolescents to take action.

Table 1. Description of questionnaires by material and type of validation.

Questionnaires and educational materials	Number of questions per type of validation	
	Technical	Population
Infograph 1. Water vs. Sugary drinks (Supplementary material 1)	14	20
Infograph 2. Refillable Bottles vs. Disposable Bottles (Supplementary material 2)	14	20
Infograph 3. My Water Fountains (Supplementary material 3)	14	20
Video 1. Personalize your Refillable Bottle and Carry It with You. (Supplementary material 4)	17	19
Video 2. Proper use of my water fountains (Supplementary material 5)	18	19

Analysis

We developed a performance index for each validation criterion, assigning numerical values to the categorical responses to the two closed and three open-ended questions. One open-ended question inquired about the clarity of the messages, another requested a description of knowledge gained, and a third asked for suggested changes. We constructed the indices by adding up the numerical values of the responses, except in the case of the criteria concerning identification and inducement to action, for which the questionnaires included only one question each and therefore required no calculations.

Table 2 shows the number of questions included to construct the indices by criterion. We categorized the index for each criterion into strong or weak compliance.

As recommended by the Pan American Health Organization (PAHO) (Organización Panamericana de la Salud, 1998), we defined successful materials as being those where $\geq 70\%$ of the validation responses were

concentrated in the strong-compliance category.

We estimated frequencies and percentages for each compliance category. For the adolescent group, we stratified the analysis by sex, and determined that statistically significant differences were those with a $p < 0.05$ value. This was accomplished by means of chi-square testing (Table 2).

For open-ended questions inquiring why respondents provided particular answers and what they liked most about the materials, we performed content analyses and established categories according to the previously described validation criteria. Analyses were thus enriched by the commentaries of the validation group members (See Supplementary Material 6).

Ethical considerations

The protocol for our study was approved by the Research Ethics Committee of the National Institute of Public Health (Registration No. 1604). The experts and adolescents participated on a voluntary and anonymous basis.

Table 2. Numbers related to questions considered to establish performance indices, by group of interest.

	Appeal	Clarity	Identification	Acceptance	Inducement to action
Group of experts					
Infograph 1	5,6,10,11,14	1,3,4,8,9	7	12,14	2
Infograph 2	5,6,10,11,14	1,3,4,8,9	7	12,14	2
Infograph 3	5,6,10,11,14	1,3,4,8,9	7	12,14	2
Video 1	7,8,9,14,15	1,3,5,11,12	10	6,13,16,18	2,4
Video 2	6,7,8,14,15	1,3,5,11,12	9,10	13,16,18	2,4
Group of adolescents					
Infograph 1	11,12,16,17,18,19	1,3,10,15	13,20	2,4,5,19	6,7,8,9
Infograph 2	11,12,16,17,18,20	1,3,10,16	13,21	2,4,5,20	6,7,8,10
Infograph 3	11,12,16,17,18,21	1,3,10,17	13,22	2,4,5,21	6,7,8,11
Video 1	8,9,10,15,16	1,4,6,12,13	11	3,7,14,17,19	2,5
Video 2	7,8,9,15,16	1,4,6,12,13	10,11	3,14,17,19	2,5

Results

Table 3 summarizes the principal participant characteristics. The group of experts included a minimum of 13 and a maximum of 15 members. In general, women were more numerous than men, nutrition was the predominant area of expertise, and over 80% of participants held a postgraduate degree.

The number of adolescent group members varied depending on the educational material reviewed. The largest number of participants was involved in the validation of Infographs 1 and 3, followed by those who validated Infograph 2, Video 1 and Video 2. A higher proportion of female adolescents participated, particularly in the case of Infograph 1, while the proportions were more homogeneous for the other materials. The average age of participants was approximately 13 years. In general, more adolescents from public as opposed to private schools participated, except in the case of Video 2: in this instance, more than 80% of participants were from private schools. Over 80% of adolescents reported studying in the mornings. The distribution of participants by school grade

was generally homogeneous, apart from the validation of Video 2: in this instance, the number of adolescents from the first and second years of middle school exceeded the number of third year students.

Table 4 displays the results for the group of experts. Between 80% and 100% of participants reported strong compliance for all educational materials based on criteria pertaining to their appeal, clarity, acceptance and ability to induce action. However, the scores for strong compliance were low for the three infographs, but high for the videos regarding identification.

Table 5 shows the results for the adolescent group. Between 84.4% and 100% of participants reported strong compliance for all educational materials based on criteria pertaining to their appeal, clarity, acceptance and ability to induce action. As regards identification, however, the scores for strong compliance were extremely low for the three infographs, low for Video 2 and high for Video 1. We observed no significant difference by sex even in the case of Video 1, with more female (88.9%) than male (62.5%) youths expressing a positive opinion of the identification criterion.

Table 3. General participant characteristics.

Group of experts					
	Infograph 1	Infograph 2	Infograph 3	Video 1	Video 2
Number of participants	15	15	14	14	13
Sex, % (n)					
Men	26.7 (4)	26.7 (4)	21.4 (3)	21.4 (3)	23.1 (3)
Women	73.3 (11)	73.3 (11)	78.6 (11)	78.6 (11)	76.9 (10)
Academic background, % (n)					
Educational Sciences	6.7 (1)	6.7 (1)	7.1 (1)	7.1 (1)	7.7 (1)
Communication and Journalism	6.7 (1)	6.7 (1)	7.1 (1)	7.1 (1)	0 (0)
Nursing	13.3 (2)	13.3 (2)	14.3 (2)	14.3 (2)	15.4 (2)
Medicine	13.3 (2)	13.3 (2)	7.1 (1)	7.1 (1)	7.7 (1)
Nutrition	46.7 (7)	46.7 (7)	50 (7)	50 (7)	53.9 (7)
Psychology	13.3 (2)	13.3 (2)	14.3 (2)	14.3 (2)	15.4 (2)
Postgraduate level, % (n)					
Master's degree	86.7 (13)	86.7 (13)	85.7 (12)	85.7 (12)	84.6 (11)
Doctorate degree	13.3 (2)	13.3 (2)	14.3 (2)	14.3 (2)	15.4 (2)

Table 3. (Continued).

Group of adolescents					
	Infograph 1	Infograph 2	Infograph 3	Video 1	Video 2
Number of participants	39	18	32	17	13
Sex, % (n)					
Men	28.2 (11)	44.4 (8)	40.6 (13)	47.1 (8)	46.2 (6)
Women	71.8 (28)	55.6 (10)	59.4 (19)	52.9 (9)	53.9 (7)
Age in years, X (\pm SD)	13.5 (1.2)	12.9 (1.2)	13.6 (1.1)	13.6 (0.9)	13.2 (1.1)
Type of school, % (n)					
Public	61.5 (24)	61.1 (11)	75.0 (24)	75.6 (13)	15.4 (2)
Private	38.5 (15)	38.9 (7)	25.0 (8)	23.5 (4)	84.6 (11)
Classes, % (n)					
Morning	94.9 (37)	83.3 (15)	87.5 (28)	88.2 (15)	100 (13)
Afternoon	5.1 (2)	16.7 (3)	12.5 (4)	11.8 (2)	0 (0)
Year / middle school, % (n)					
First	33.3 (13)	38.9 (7)	31.3 (10)	29.4 (5)	46.2 (6)
Second	30.8 (12)	38.9 (7)	43.8 (14)	35.3 (6)	46.2 (6)
Third	35.9 (14)	22.2 (4)	25.0 (8)	35.3 (6)	7.7 (1)

Table 4. Strong-compliance scores, by educational material and validation criterion: group of experts, %

Materials	Appeal	Acceptance	Identification	Clarity	Inducement to action
Infograph 1	100 (15)	80.0 (12)	50.0 (7)	100 (15)	93.3 (14)
Infograph 2	100 (15)	86.7 (13)	53.3 (8)	100 (15)	93.3 (14)
Infograph 3	100 (14)	85.7 (12)	28.6 (6)	100 (14)	78.6 (11)
Video 1	100 (14)	100 (14)	85.7 (12)	100 (14)	100 (14)
Video 2	100 (13)	100 (13)	92.3 (12)	100 (13)	100 (13)

Table 5. Strong-compliance scores, by educational material and validation criterion: group of adolescents according to sex, % (n).

Men					
Materials	Appeal	Acceptance	Identification	Clarity	Inducement to action
Infograph 1	100 (11)	100 (11)	9.1 (1)	90.9 (10)	90.9 (10)
Infograph 2	100 (8)	87.5 (7)	0.0 (0)	87.5 (7)	100 (8)
Infograph 3	100 (13)	92.3 (12)	7.7 (1)	92.3 (12)	92.3 (12)
Video 1	100 (8)	100 (8)	62.5 (5)	100 (8)	100 (8)
Video 2	100 (6)	100 (6)	50 (3)	100 (6)	100 (6)
Women					
Materials	Appeal	Acceptance	Identification	Clarity	Inducement to action
Infograph 1	100 (28)	100 (28)	10.7 (3)	100 (28)	100 (28)
Infograph 2	100 (10)	100 (10)	10.0 (1)	10.0 (1)	90.0 (9)
Infograph 3	100 (19)	89.5 (17)	5.3 (1)	89.5 (17)	79.0 (15)
Video 1	100 (9)	100 (9)	88.9 (8)	100 (9)	100 (9)
Video 2	100 (7)	100 (7)	42.9 (3)	100 (7)	100 (7)
Both					
Materials	Appeal	Acceptance	Identification	Clarity	Inducement to action
Infograph 1	100 (39)	100 (39)	10.3 (4)	97.4 (38)	97.4 (38)
Infograph 2	100 (18)	94.4 (17)	5.6 (1)	94.4 (17)	94.4 (17)
Infograph 3	100 (32)	90.6 (29)	6.3 (2)	90.6 (29)	84.4 (27)
Video 1	100 (17)	100 (17)	76.5 (13)	100 (17)	100 (17)
Video 2	100 (13)	100 (13)	46.2 (2)	100 (13)	100 (13)

Discussion

The validations by technical specialists and representatives of the population shed light on the strengths and weaknesses of each educational material regarding content and design. This information is useful for turning recommended actions into healthy practices such as consistent water consumption and the use of school drinking fountains (Flores Huerta et al., 2011). It thus directly contributes to combating the problems of overweight and obesity among Mexican adolescents in middle school (Shamah-Levy et al., 2018).

The principal results of our study showed that both experts and adolescents registered high scores in the strong-compliance category for all materials according to the criteria for appeal, clarity, acceptance and inducement to action. They particularly liked the information and also

appreciated the way it was explained through images and colors. Similar results were obtained by Costa-de-Oliveira et al., who reported that information combined with images achieved greater acceptance, motivated the audience to read, and facilitated understanding of the messages (de Oliveira et al., 2014). The materials were well received by both validation groups. No participants reported feeling judged either personally or in regard to their beliefs, or found any ideas to be out of context. The materials meet the PAHO criterion for acceptance, as they were approved by the population of interest and were found to be viable and accessible (Ziemendorff & Krause, 2003).

The messages were considered clear, and we noted that both the expert and adolescent groups understood them correctly. According to Vio et al., validating educational materials allows for analyzing different points

of view regarding the contents. It serves to identify the social and cultural perspectives of a group similar to the population of interest, and simultaneously permits verifying compliance with the objectives of the materials. This prevents the audience from coming to an erroneous or partial understanding of the messages, thereby reducing their effectiveness (Vio et al., 2012).

Regarding inducement to action, the comments of the adolescents in our study indicated that they would definitely follow the recommendation to consume water as promoted in the material. Participants stated that they intended to modify their habits and encourage their schoolmates and friends to do the same –precisely the essence of the criterion (Ziemendorff & Krause, 2003)– thus demonstrating the potential of the material to provoke behavioral change in the desired direction. It is important to note that, in addition to disseminating the materials in the course, the Schools Promoting Water Consumption (EPCA) strategy aims to reinforce these behaviors by organizing healthy challenges and competitions. This is expected to create synergy with the materials: according to the Social Cognitive Theory (SCT), people will voluntarily adopt healthy behaviors as long as they are provided with the necessary skills and knowledge, thereby inspiring confidence. In addition, making these behavioral changes requires an environment offering opportunity, social support and positive reinforcement, helping the individuals concerned to internalize the desired healthy behavior and encouraging them to repeat it until it becomes a habit (Bandura & Walters, 1977).

Validation also allowed for identifying those aspects with which both the experts and adolescents were, to some degree, dissatisfied, leading to modifications such as increasing the size of the letters and including more images in the infographs and videos.

Based on the identification criterion, the group of experts accorded low scores to the infographs in the strong-compliance category, as did the adolescents; the latter also rated Video 2 as poor. These assessments led us to replace the original images with others more representative of the group of interest. Furthermore, the respondents proposed that the images of the adolescents in the materials be more diverse in terms of hairstyles, skin tones and complexions. These suggestions are consistent with the literature documenting that materials that better reflect the diversity of the population of interest are more widely accepted (Atchison et al., 2010; Bar-Zeev et al., 2017; Salazar-Coronel et al., 2012).

The fact that validations were performed by professionals in diverse fields represents one of the strengths of this study. Bringing expertise in

communication, medicine, nursing, nutrition, pedagogy and psychology to the process helped these experts categorize specialized knowledge according to the topics addressed by the materials. The contributions of the group of adolescents, representative of the population of interest, were fundamental to the elaboration of material adapted to their context with the aim of helping them identify with the behavior being promoted. The interpretations of researchers may differ from the day-to-day reality of the audiences for whom the messages are intended. Engaging adolescents in our validation process allowed us to ascertain their perceptions of their own culture, traditions, language and economic conditions. Their input illustrated the ways in which the intended audience perceives and understands the information contained in the materials, thus enabling us to adapt them and enhance their effectiveness. We used similar tools for the assessment by the experts and adolescents, allowing us to compare the perceptions of the two groups and gain a better understanding of the way Mexican adolescents think. Taking the latter into account has previously been shown to enhance the effectiveness of educational materials (Bomfim Costa et al., 2013; Guimarães et al., 2015; Nasbine et al., 2012).

In addition to the above, the validated materials were found to be standardized. All included the same contents to make certain that the population of interest received congruent messages across different media (infographs and videos), thus facilitating learning and ensuring that the messages reinforced one another.

One of the primary limitations to the process of validation was the fact that it was carried out during the COVID pandemic. However, this led us to seek alternative forms of interaction among experts and adolescents and to rely on virtual media, including email and social networks such as WhatsApp and Facebook. We confirmed that social networks have become an effective collaborative tool, encouraging cooperation and providing space for the exchange of information. Utilizing virtual technology permitted us to achieve our validation objectives without jeopardizing the health of participants. It also yielded savings on economic, human and material resources, and highlighted the usefulness of digital media in health-related research, as documented in other studies (Moorhead et al., 2013; Moura De Araújo et al., 2010).

Another study limitation was related to participant fatigue when faced with the need to review and evaluate a substantial number of educational materials in a short time. As a result, the participation rate declined, rendering it impossible to maintain a homogeneous

number of participants throughout the validation process; it was necessary to allow participants additional time to respond. Nonetheless, even with a lower response rate, we found that the answers to the closed and open-ended questions were consistent, providing valuable information for improving the educational materials (Ziemendorff & Krause, 2003). We therefore recommend forming several validation groups and assigning a maximum of two materials per person. This would avoid participant saturation and contribute to achieving a quality review process.

Conclusions

The validation process allowed us to identify strengths and areas for improvement of the educational materials, while demonstrating their usefulness and potential. Our results are consistent with the findings of other studies which have previously documented that validating materials ensures the effectiveness of health-promotion and educational interventions (Díaz, 2007; Liévano-Fiesco et al., 2009; Moura De Araújo et al., 2010). Our study can therefore help guide health promoters from other contexts, as the utility of validating educational materials is undeniable in averting unnecessary expenses in the production of materials that may not have the expected impact (Barrera et al., 2011; Salazar-Coronel et al., 2012). We highly recommend validating materials prior to producing and replicating them.

During the 2022 school year, we implemented and evaluated the effectiveness of the course designed by the EPCA initiative for Mexican middle-school adolescents: “I choose, drink and promote the consumption of water.” We used the educational materials that were improved as a result of our validation study and are preparing to publish the results.

Author contributions

The authors equally participated in the preparation of the manuscript and approved the final version presented.

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Data Availability Statement

The data presented in this study are available upon request from the corresponding author.

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Conflict of interest

The authors declare that they have no competing interests.

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