

Maximising the completeness of Sexuality Information for Safer Sexual Behaviour among Young People in Uganda's Island Communities: A Structural Equation Modelling Approach

Venantius Bbaale Kirwana

venbbak@gmail.com

Makerere University

Christian Kakuba

Makerere University

Allen Kabagenyi

Makerere University

Patricia Ndugga

Makerere University

Misinde Cyprian

Makerere University

Stephen Wandera

Makerere University

Research Article

Keywords: sexuality, sexuality information, completeness, risky sexual behaviour, safer sexual behaviour

Posted Date: March 19th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9155755/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Public Health on September 3rd, 2026. See the published version at <https://doi.org/10.1186/s12889-026-29197-w>.

**Maximising the completeness of Sexuality Information for Safer Sexual Behaviour
among Young People in Uganda's Island Communities: A Structural Equation
Modelling Approach**

*Venantius Bbaale Kirwana ^{*1}, Christian Kakuba², Allen Kabagenyi¹, Patricia Ndugga ¹, Misinde Cyprian¹,
Stephen Wandera¹.*

1 Makerere University, School of Statistics and Planning, Department of Population Studies

2 Makerere University, School of Statistics and Planning, Department of Planning and Applied Statistics

ABSTRACT

Background: Sexuality information is critical for promoting safer sexual behaviour among young people. However, while access to sexuality information has expanded, limited attention has been given to ensuring its completeness and alignment with young people's preferred sources, resulting in fragmented and less effective learning. These gaps are particularly evident in Uganda's island communities. This paper develops a sexuality information provision model from young people's preferred sources of sexuality information, which maximizes completeness to support safer sexual behaviour.

Methods: Using a concurrent mixed methods study, data were collected from 569 young people aged 10-24 years, using digital surveys. Data were analyzed using descriptive statistics. Actuals and preferred sources of sexuality information were compared using the McNemar test. Structural equation modeling was used to generate a model that maximizes sexuality information completeness from preferred sources of sexuality information. Ethical approval consent and child protection procedures were strictly followed.

Findings: A well-fitting modified structural equation model ($\chi^2 = 206.5$, $p < 0.001$; RMSEA = 0.061, 90% CI: 0.051–0.070; SRMR = 0.048; CFI = 0.968; TLI = 0.945), highlights Books and recordings consistently having strongest effects across topics ($\beta = 0.260$ – 0.587 ; $p < 0.001$), followed by friends/confidants ($\beta = 0.086$ – 0.220 ; $p < 0.05$) and biological parents and guardians ($\beta = 0.049$ – 0.252 ; $p < 0.05$). Healthcare workers significantly contributed to biomedical topics such as body development, pregnancy, HIV, and STIs ($\beta = 0.173$ – 0.214 ; $p <$

0.001), for all topics to significantly predict sexuality information completeness ($\beta = 0.760$ – 1.413 ; $p < 0.001$).

Conclusion: Complete sexuality information for young people can be achieved from multiple sources. Prioritizing programs targeting parents to provide sexuality information with the aid of books and recordings, in a friendly manner, can promote safer sexual behaviour among young people.

Keywords: *sexuality, sexuality information, completeness, risky sexual behaviour, safer sexual behaviour*

Background

Sexuality information is widely recognised as a critical strategy for promoting safer sexual behaviour and improving sexual and reproductive health outcomes among young people. Recent global evidence affirms that when sexuality information is accurate, age-appropriate, complete, and comprehensive, it contributes to delayed sexual initiation, increased contraceptive use, and healthier relationship dynamics (1,2). However, despite broad consensus on the importance of sexuality information, much of the focus in policy and programming has been placed on whether young people receive sexuality information, with limited attention to how complete that information is and whether it is delivered through sources young people actually trust and prefer(3).

A growing body of literature indicates that young people commonly receive sexuality information in fragmented and uneven ways, resulting in partial knowledge, persistent misconceptions, and limited skills for safer sexual decision-making (4,5). This fragmentation is not only about missing topics; it is also shaped by a critical mismatch between the sources that actually provide sexuality information and the sources that young people would prefer to receive information from for specific topics. Evidence increasingly shows that young people do not perceive sexuality information sources as interchangeable(3). Instead, they differentiate sources by topic, selecting those they consider most trustworthy, knowledgeable, private, or socially acceptable for particular aspects of sexuality.

In many settings, including Uganda, young people often receive information about biological development and disease prevention from teachers or health workers. At the same time, topics such as relationships, consent, gender norms, and emotional aspects of sexuality are left to peers, media, or informal conversations. Yet studies consistently show that young people would prefer to discuss sensitive and value-laden topics, such as relationships, sexual decision-

making, and bodily changes, with parents, trusted adults, or trained health providers, rather than peers or unregulated media (6,7). This discrepancy between actual sources and preferred sources contributes directly to incomplete sexuality information, as some topics are either avoided, poorly explained, or delivered by sources that young people do not fully trust.

Uganda's demographic context amplifies the importance of addressing this mismatch. Young people aged 10–24 years constitute approximately one-third of the national population, placing sexuality information at the centre of the country's public health and development agenda (8). Although Uganda has a National Sexuality Education Framework, its implementation has been uneven and contested, shaped by political, cultural, and religious debates that have narrowed classroom content and constrained teacher discretion (9). As a result, schools often deliver a limited subset of sexuality topics, primarily biological and risk-focused content, while omitting or superficially addressing domains related to gender, consent, sexual diversity, and relationships, areas where young people report strong preferences for trusted and confidential sources (10,11).

These challenges are particularly pronounced in Uganda's island communities, where geographical isolation, limited educational infrastructure, transport barriers, and seasonal mobility associated with fishing livelihoods restrict young people's access to formal sexuality education (12,13). In such contexts, young people frequently obtain sexuality information from peers, informal media, or social networks by default rather than by preference. Although parents, health workers, and trained educators are commonly preferred sources for sensitive or technical sexuality information, their effectiveness is often limited by absence, inaccessibility, or cultural norms that inhibit open discussion (14–16). Consequently, the gap between where information is obtained and where young people would prefer to obtain it is widened, further undermining completeness.

This study defines completeness of sexuality information as the extent to which young people receive information across all eight topics outlined in UNESCO's International Technical Guidance on Sexuality Education: relationships; values, rights, and culture; understanding gender; violence and safety; skills for health and well-being; human body and development; sexual and reproductive health; and the sexual life cycle (4,5,17). The absence characterises incomplete sexuality information or inadequate coverage of one or more of these domains, often resulting from topic–source mismatches in which information is delivered by sources that young people neither prefer nor fully trust. Such mismatches have been linked to poorer comprehension, reduced engagement, and weaker translation of knowledge into safer sexual behaviour (18,19).

The study is grounded in an integrated theoretical framework combining the Bioecological Theory, Social Learning Theory, and the Information-Motivation–Behavioural Skills (IMB) model. The bioecological perspective highlights that young people's sexuality learning occurs across multiple interconnected systems, including families, peers, schools, communities, and broader sociocultural contexts (20). Social Learning Theory explains how the credibility and visibility of different sources influence whether young people attend to, internalise, and act on sexuality information (21). The IMB model further underscores that information is most likely to influence behaviour when it is both comprehensive and delivered through sources that foster motivation and skill-building (22).

Using data on young people's preferred sources of sexuality information by content domain, the study employs Structural Equation Modelling (SEM) to estimate how different sources, individually and in combination, contribute to the completeness of sexuality information and, indirectly, to safer sexual behaviour. SEM is particularly appropriate because it allows for the

modelling of latent constructs such as completeness, captures complex interrelationships among multiple information sources and topics, and quantifies the effects of aligning information delivery with young people's preferences.

By developing a sexuality information provision model that aligns what is taught with who young people prefer to learn from, this study moves beyond access-based and school-centric approaches. It provides empirical evidence on how strategic alignment of information sources can maximise completeness and strengthen safer sexual behaviour outcomes among young people in Uganda's island communities. This approach contributes to more context-sensitive, equitable, and effective sexuality information strategies and supports Uganda's commitments under the Sustainable Development Goals, particularly SDG 3 on health and SDG 4 on quality education.

METHODOLOGY

Study design and setting

This study adopted a convergent mixed-methods design that integrated both quantitative and qualitative approaches to develop a sexuality information provision model that maximises completeness to support safer sexual behaviour among young people in Uganda's island communities. Mukono District was randomly selected from the seven island districts of Lake Victoria using the ballot method, where the names of all eligible island districts were written on identical slips of paper, mixed in a container, and one was drawn blindly to ensure fairness and transparency. Within Mukono District, Kkoome Subcounty, the only island subcounty was purposively chosen because of its geographic isolation, diverse youth population, and relevance to the study objectives. From the four parishes that make up Kkoome (Bugombe, Busanga,

Lwomolo, and Mubembe), Busanga and Bugombe parishes were selected using the ballot method. The study population comprised young people aged 10–24 years, estimated at 345,000(8), and adults and community actors, including parents, guardians, religious leaders, cultural representatives, community leaders, healthcare workers, and teachers living in the island communities of Lake Victoria.

Sampling, data collection, and analysis

The sample size of young people was determined using Yamane & Israel, (1967) formula for determining the sample size of a known population to have a representative sample of young people in the Island Communities of Lake Victoria.

$$n = \frac{N}{1 + Ne^2} * 100/70.2$$

Where: n=Sample Size, N=Size of the Target Population (345,000), e=Margin Error/Level of Precision (which is 0.05), bring the number of young people who participated in the study to 569.

Data were collected at a single point in May 2025, following ethical approval from TASO and a research permit (SS3785ES) from the Uganda National Council for Science and Technology, using structured interviewer-administered surveys. A sampling frame of all villages in each of the two parishes was developed in collaboration with the subcounty Community Development Officer, parish officials, and Local Council (LC I) leaders. In each parish, six villages were purposively selected with a high concentration of young people aged 10–24 years, accessibility

during the study period, and representation of both landing-site and inland communities. Within each village, household listings identified households with at least one eligible young person. Where more than one eligible individual was present, a simple random selection method was applied by drawing numbered slips. This minimized intra-household selection bias. This approach ensured balanced representation across developmental stages and gender. Community leaders supported participant identification while maintaining randomness and ethical standards.

The survey captured two main domains: completeness of sexuality information and risky sexual behaviours. Completeness of SI; the dependent variable, was measured against eight UNESCO (2018) comprehensive sexuality education topics: t1) healthy relationships, t2) values and rights, t3) gender equity, t4) privacy and staying safe, t5) communication, negotiation and decision-making, t6) human body and development, t7) sexual and reproductive health, and t8) sexual lifecycle and response.

Direct sources of sexuality information were captured and included in the study as 1) microsystem: s1a. biological parents, s1b. siblings and s1c. other guardians; 2) mesosystem: s2a. friends/confidants, s2b. peer educators, s2c. teachers, s2d. religious leaders, s2e. healthcare workers, s2f. community leaders, s2g. the internet, s2h. book or recording. Data confidentiality and anonymity were ensured through pseudonymisation of respondents with unique IDs, and participants were reassured that their responses would never be traced back to them.

Quantitative data were analysed using STATA 18. Univariate analysis described the distribution of variables using frequencies, percentages, means, and standard deviations. The structural relationships in the hypothesised model were expressed as:

$$T_j = \alpha_j \sum_{i=1}^k \gamma_{ji} S_i + \varepsilon_j$$

For $\eta = \lambda_1 T_1 + \lambda_2 T_2 + \dots + \lambda_k T_k + \zeta$

T_j denotes sexuality information topic

S_i represents preferred sexuality information sources

η is the latent variable of sexuality information completeness

λ and γ are path coefficients, and ε and ζ are error terms

Following initial estimation, the model was refined to improve parsimony. The modified model was generated by eliminating negative and statistically non-significant pathways while retaining theoretically meaningful associations. Covariances among sexuality topics were preserved to capture their interaction effects. This iterative process produced a more theoretically coherent model that identified the combination of preferred sources most strongly associated with maximizing sexuality information completeness.

Parameters were estimated using maximum likelihood estimation. Model fit was evaluated using the chi-square statistic (χ^2), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), applying conventional thresholds for acceptable fit. The final model was interpreted to determine the optimal configuration of information sources for strengthening sexuality information completeness among young people in island settings.

RESULTS

Socio-demographic characteristics of young people in the study.

Table 1a. Summarizes the characteristics of study participants. A total of 569 young people participated in the study, with almost equal representation from Bugombe parish (49.2%) and Busanga parish (50.8%). Female study participants were 51.3%, while the males were 48.7%. The average age of study participants was 16.4 years, with a standard deviation of 3.16 years. Relatedly, 37.6 % of the respondents were in the age bracket of 18–24 years, 31.3 % were in that of 10–14 years, and another one-third (31.1%) of the respondents were aged 15–17 years.

Most participants were peri-urban residents (83.5%), and the majority identified themselves as Christian (88.4%). About six for every ten respondents (61.0%), were not school going at the time of our survey. Nearly all study participants had attained at least primary education (98.2%). Over half of the study respondents (56.2%) were unemployed, while 43.8% were engaged in some form of work. Close to six for every ten study participants (59.4%) reported belonging to a youth club or group. Living arrangements varied, with 40.3% of the study participants living alone, 17.8% living with biological parents, 16.3% living with a spouse, and 25.7% living with other relatives or guardians.

Table 1. Socio-demographic characteristics of study participants

Note: this table is adapted from Kiwana et al (2025) with permission(3)

Socio-demographics of young people	Categories	Frequency	Percentage
Parish	Bugombe	280	49.2
	Busanga	289	50.8
Age group 16.433±3.155	10-14years	178	31.3
	15-17years	177	31.1
	18-24years	214	37.6
Sex	Female	292	51.3
	Male	277	48.7
Residence	Rural	94	16.5
	Peri-Urban	475	83.5
Religion	Catholic	309	54.3

	Muslim	42	7.4
	Pentecostal	106	18.6
	Protestant	88	15.5
	Traditionist	24	4.2
Schooling status	No	347	61.0
	Yes	222	39.0
Education level	None	10	1.8
	Primary	227	39.9
	Secondary	298	52.3
	Tertiary/University	34	6.0
Employment status	No	320	56.2
	Yes	249	43.8
Belong to a club/group	No	231	40.6
	Yes	338	59.4
Living arrangements	Alone	229	40.3
	Biological Parent	101	17.8
	Spouse	93	16.3
	Other	146	25.6
Receiving Sexuality by Observation	No	196	34.4
	Yes	373	65.6
Receiving sexuality information verbally	No	139	24.4
	Yes	430	75.6
Receiving sexuality information by reading	No	538	94.6
	Yes	31	5.4
Receiving through video or games	No	560	99.8
	Yes	1	0.2

The most common channel of sexuality information was verbal communication (75.6%), followed by observation (65.6%). Very few study participants reported receiving SI through reading (5.5%) or videos/games (0.2%).

Across the microsystem (Table 2), biological parents were among the most preferred sources, yet their actual involvement remained markedly low. For example, in Topic 1, only 14.2% of respondents reported parents as an actual source compared to 35.7% who preferred them, a gap of 21.5 percentage points. Similar gaps were observed across other topics, with parental preference exceeding actual access by 10–25 percentage points.

Siblings and guardians also showed notable discrepancies. In Topic 2, siblings were an actual source for only 1.2% of respondents, while 10.0% preferred them, reflecting an 8.8-point gap. Guardians were virtually absent as actual sources across most topics (often below 1%), despite preference levels ranging between 3% and 11%.

Table 2. Actual and preferred source of sexuality information from the micro and meso systems

Source of sexuality information		Microsystem %			Mesosystem %							
		Biological parents	Siblings	Guardians	Friend / Confidant	Peer	Teacher	Religious leader	Community leader	Healthcare worker	Internet	Book or recording
Topic 1: Healthy Relationships	Actual	14.2	9.5	8.4	4.0	0.2	15.5	19.3	3.3	7.0	0.5	0.4
	Preferred	35.7	26.0	11.3	24.1	4.8	21.3	25.1	2.8	10.4	5.8	48.9
Topic 2: Values and Rights	Actual	7.4	1.2	0.2	0.0	3.2	0.9	1.1	16.7	0.9	0.2	0.4
	Preferred	25.7	10.0	3.9	25.7	9.5	17.8	2.8	1.8	2.1	6.0	48.5
Topic 3: Gender equality and equity	Actual	0.4	10.7	0.0	7.6	0.0	0.2	7.6	7.6	4.0	0.4	0.2
	Preferred	13.9	14.1	3.0	14.4	3.7	11.8	13.0	2.8	6.2	6.0	48.9
Topic 4: Violence Prevention and Staying Safe	Actual	1.1	5.8	0.4	12.3	0.0	0.9	4.4	1.2	0.9	0.2	0.2
	Preferred	19.2	5.5	3.9	21.7	1.2	11.6	25.1	1.6	14.4	5.8	48.7
Topic 5: Communication, negotiation, and decision making	Actual	1.6	7.4	3.5	11.1	0.2	9.3	8.3	0.9	4.9	0.2	0.2
	Preferred	18.1	12.5	3.0	25.0	3.9	20.9	19.9	1.8	9.0	5.8	48.9
Topic 6: Human Body & Development	Actual	1.1	0.9	0.4	1.1	0.2	22.3	4.9	1.4	15.1	0.4	0.2
	Preferred	10.7	6.3	0.2	14.8	0.9	28.5	7.2	2.5	46.6	5.8	49.2
Topic 7: Pregnancy, HIV, and STIs	Actual	4.4	0.5	0.0	5.3	0.2	27.1	4.0	7.6	16.2	0.7	0.2
	Preferred	19.5	2.8	3.3	10.4	1.1	30.2	5.5	3.2	47.3	5.8	48.9
Topic 8: Sexual lifecycle and response	Actual	0.4	0.5	3.5	3.7	3.3	9.8	0.2	9.7	1.1	0.4	0.2
	Preferred	8.4	6.0	0.2	8.3	2.6	18.6	0.9	1.1	6.9	5.8	48.2

Friends and confidants were more frequently accessed than family members, but still fell short of preference. For instance, in Topic 5, 11.1% reported friends as an actual source compared to 25.0% who preferred them, a difference of 13.9 percentage points. Peer sources were consistently minimal in actual use (often below 5%) despite preference levels of up to 9.5%.

Teachers and healthcare workers showed relatively higher actual use but still exhibited significant gaps. In Topic 6, teachers were an actual source for 22.3% of respondents, yet 28.5% preferred them (6.2-point gap). Healthcare workers showed even larger disparities; in Topic 7, 16.2% reported actual access compared to 47.3% preference, representing a 31.1-percentage-point gap.

The most pronounced differences were observed for media-based sources. Across all topics, books or recordings were preferred by approximately 48–49% of respondents, yet actual use remained consistently below 1%, resulting in gaps of over 47 percentage points. Similarly, the internet was preferred by 5–10% of respondents across topics but was used by fewer than 1%

in most cases. Community and religious leaders recorded both low actual and low preferred percentages, typically below 5%, with minimal gaps, indicating limited demand and engagement.

The findings reveal a systematic mismatch of 10–47 percentage points between preferred and actual information sources. Young people consistently prefer trusted, knowledgeable, and private sources, particularly parents, teachers, healthcare workers, and credible media, but rely on these far less in practice, highlighting critical structural, cultural, and access-related barriers.

Hypothesising a structural equation model for maximising the completeness of sexuality information provision

The initial model included all preferred sources of sexuality information in the microsystem and the mesosystem by topic, and the interaction across topics for sexuality information completeness; as shown in the Figure 1 and Table 3.

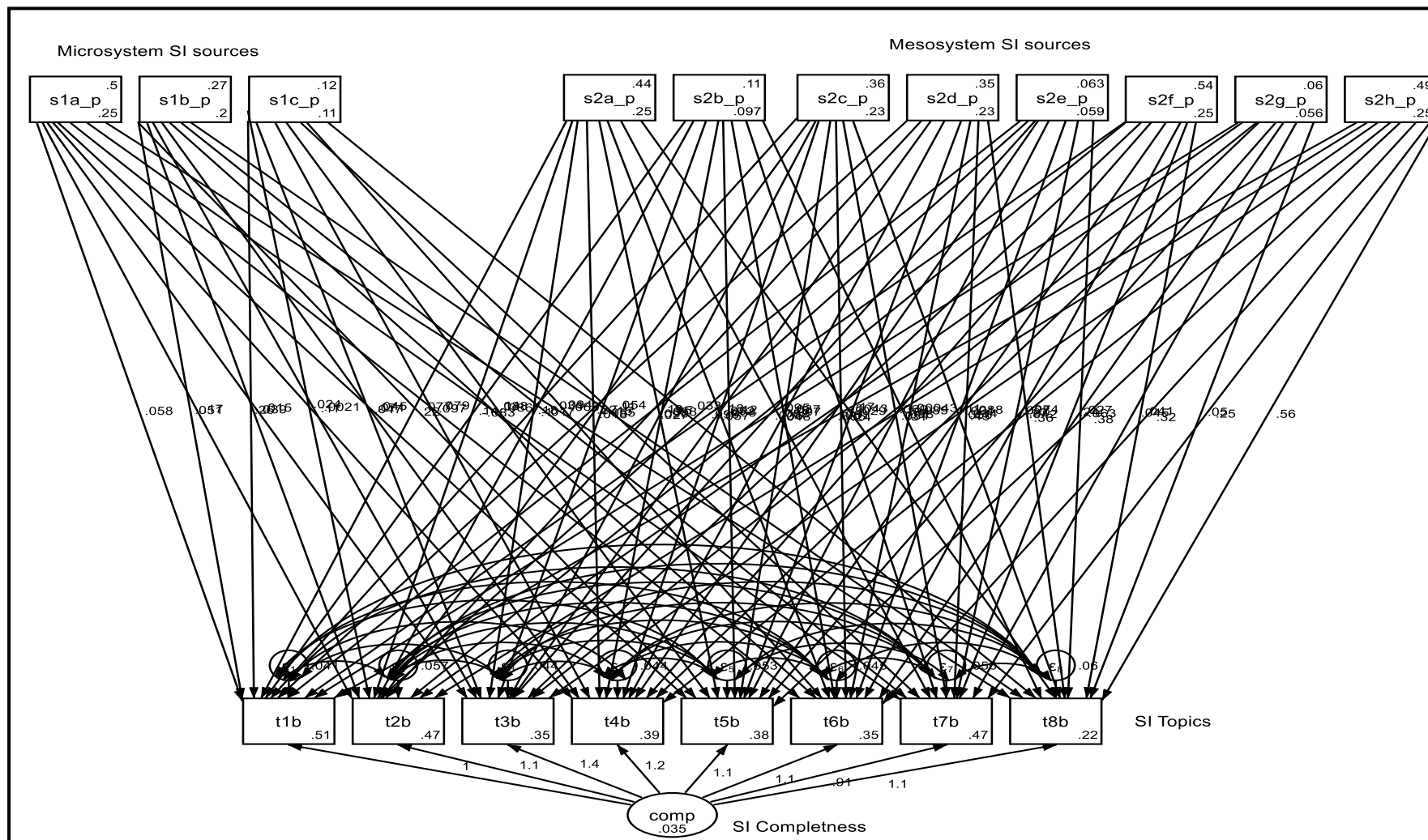


Figure 1. Hypothetical SEM for sexuality information provision

Table 3. Hypothetical structural equation matrix sheowing pathways to complete sexuality information

Structural	Path	Coefficient(β) [CI]	p-values
<i>Topic1</i>	<i>Health Relationships</i>		
Biological parents	Biological parents → Topic 1	0.058[0.004 - 0.113]	0.036*
Siblings	Siblings	0.051[-0.010 - 0.112]	0.100
Guardians	Guardians	0.260[0.185 - 0.335]	0.000*
Friends	Friends	0.221[0.170 - 0.273]	0.000*
Peer educators	Peer educators	-0.083[-0.165 - -0.001]	0.049*
Teachers	Teachers	0.102[0.029 - 0.174]	0.006*
Religious Leaders	Religious Leaders	0.018[-0.053 - 0.090]	0.620
Community Leaders	Community Leaders	0.027[-0.073 - -0.127]	0.594
Healthcare workers	Healthcare workers	0.057[-0.001-0.114]	0.053
Internet	Internet	0.048[-0.052-0.148]	0.345
Books and Recordings	Books and Recordings	0.239[0.191-0.287]	0.000*
<i>Topic2</i>	<i>Values, rights, and responsibilities</i>		
Biological parents	Biological parents	0.175[0.118 - 0.233]	0.000*
Siblings	Siblings	0.039[-0.025- 0.104]	0.228
Guardians	Guardians	0.024[-0.054 - 0.103]	0.543
Friends	Friends	0.135[0.081 - 0.190]	0.000*
Peer educators	Peer educators	-0.017[-0.104 - 0.0700]	0.701
Teachers	Teachers	-0.055[-0.132 - 0.021]	0.156
Religious Leaders	Religious Leaders	0.096[0.021 - 0.172]	0.012*
Community Leaders	Community Leaders	0.096[-0.010 - 0.202]	0.075
Healthcare workers	Healthcare workers	0.036[-0.024 - 0.097]	0.240
Internet	Internet	0.036[-0.069 - 0.141]	0.503
Books and Recordings	Books and Recordings	0.314[0.263 -0.365]	0.000*
<i>Topic3</i>	<i>Gender equality and equity</i>		
Biological parents	Biological parents	0.0150[-0.045 - 0.0747]	0.622
Siblings	Siblings	0.111[0.044 - 0.178]	0.001*
Guardians	Guardians	0.047[-0.035 - 0.129]	0.260
Friends	Friends	0.184[0.127 - 0.240]	0.000*
Peer educators	Peer educators	-0.145[-0.236 - -0.055]	0.002
Teachers	Teachers	0.058[-0.021 -0.138]	0.150
Religious Leaders	Religious Leaders	0.068[-0.010 -0.147]	0.088
Community Leaders	Community Leaders	0.082[-0.028 - 0.193]	0.142
Healthcare workers	Healthcare workers	0.061[-0.002 - 0.124]	0.058
Internet	Internet	0.054[-0.056 -0.164]	0.334
Books and Recordings	Books and Recordings	0.432[0.378 - 0.485]	0.000*
<i>Topic4</i>	<i>Privacy, bodily autonomy and staying safe</i>		
Biological parents	Biological parents	-0.002[-0.06 - 0.056]	0.942

Siblings	Siblings	0.071[0.006 - 0.137]	0.032*
Guardians	Guardians	0.097[0.017 - 0.177]	0.017*
Friends	Friends	0.221[0.166 - 0.277]	0.000*
Peer educators	Peer educators	-0.154[-0.243 - -0.066]	0.001
Teachers	Teachers	0.052[-0.025-0.130]	0.188
Religious Leaders	Religious Leaders	0.097[0.020-0.173]	0.013*
Community Leaders	Community Leaders	0.142[0.035 - 0.250]	0.009*
Healthcare workers	Healthcare workers	0.098[0.037 - 0.160]	0.002*
Internet	Internet	0.056[-0.051 - 0.163]	0.304
Books and Recordings	Books and Recordings	0.360[0.308 - 0.411]	0.000*
<i>Topic5</i>	<i>Communication, decision making, and negotiation</i>		
Biological parents	Biological parents	0.045[-0.015-0.105]	0.140
Siblings	Siblings	0.077[0.010 - 0.144]	0.024*
Guardians	Guardians	0.086[0.004 - 0.168]	0.039*
Friends	Friends	0.193[0.136 - 0.249]	0.000*
Peer educators	Peer educators	-0.116[-0.206 - -0.025]	0.012
Teachers	Teachers	0.183[0.104 - 0.263]	0.000*
Religious Leaders	Religious Leaders	0.029[-0.049 - 0.107]	0.469
Community Leaders	Community Leaders	-0.040[-0.150 - 0.070]	0.472
Healthcare workers	Healthcare workers	0.034[-0.029 - 0.097]	0.287
Internet	Internet	0.042[-0.067 - 0.152]	0.449
Books and Recordings	Books and Recordings	0.379[0.326 - 0.432]	0.000*
<i>Topic6</i>	<i>Body changes and development</i>		
Biological parents	Biological parents	0.079[0.026 - 0.132]	0.004*
Siblings	Siblings	0.038[-0.0219 - 0.098]	0.214
Guardians	Guardians	0.065[-0.008 - 0.138]	0.083
Friends	Friends	0.183[0.133 - 0.234]	0.000*
Peer educators	Peer educators	-0.037[-0.118 - 0.044]	0.373
Teachers	Teachers	0.112[0.041 - 0.183]	0.002*
Religious Leaders	Religious Leaders	-0.089[-0.159 - -0.019]	0.013
Community Leaders	Community Leaders	0.091[-0.007 - 0.190]	0.069
Healthcare workers	Healthcare workers	0.269[0.213-0.326]	0.000*
Internet	Internet	0.063[-0.035 - 0.161]	0.208
Books and Recordings	Books and Recordings	0.320[0.272 - 0.367]	0.000*
<i>Topic7</i>	<i>Pregnancy, HIV and STIs</i>		
Biological parents	Biological parents	0.143[0.089 - 0.197]	0.000*
Siblings	Siblings	-0.034[-0.094 - 0.026]	0.269
Guardians	Guardians	0.107[0.033-0.181]	0.005*
Friends	Friends	0.095[0.044 - 0.146]	0.000*
Peer educators	Peer educators	-0.004[-0.086 - 0.078]	0.919
Teachers	Teachers	0.069[-0.003 - 0.141]	0.060
Religious Leaders	Religious Leaders	-0.088[-0.159 - -0.017]	0.015

Community Leaders	Community Leaders	0.028[-0.071 - 0.128]	0.578
Healthcare workers	Healthcare workers	0.242[0.185 - 0.299]	0.000*
Internet	Internet	0.045[-0.055-0.144]	0.374
Books and Recordings	Books and Recordings	0.251[0.202 - 0.299]	0.000*
<i>Topic8</i>	<i>Sex, sexual expression, cycle, and response</i>		
Biological parents	Biological parents	0.094[0.035 - 0.153]	0.002*
Siblings	Siblings	-0.054[-0.120 - 0.012]	0.110
Guardians	Guardians	-0.033[-0.114 - 0.048]	0.422
Friends	Friends	0.169[0.113 - 0.224]	0.000*
Peer educators	Peer educators	-0.001[-0.090 - 0.089]	0.992
Teachers	Teachers	0.108[0.030 - 0.187]	0.007*
Religious Leaders	Religious Leaders	0.074[-0.004 - 0.151]	0.062
Community Leaders	Community Leaders	0.027[-0.082 - 0.136]	0.625
Healthcare workers	Healthcare workers	0.041[-0.021-0.103]	0.197
Internet	Internet	0.050[-0.059 - 0.158]	0.368
Books and Recordings	Books and Recordings	0.558[0.506 - 0.611]	0.000*
Var (e. Topic 1)		0.001	.
Var (e. Topic2)		0.072	0.044*
Var (e. Topic3)		0.068	0.059
Var (e. Topic4)		0.065	0.057
Var (e. Topic5)		0.068	0.058
Var (e. Topic6)		0.057	0.049
Var (e. Topic7)		0.064	0.057
Var (e. Topic8)		0.070	0.061
co(e.Topic1,e.Topic2)		-0.005[-0.047 - 0.035]	0.781
cov(e.Topic1,e.Topic3)		-0.001[-0.008 - 0.007]	0.960
cov(e.Topic1,e.Topic4)		-0.001[-0.008 - 0.007]	0.829
cov(e.Topic1,e.Topic5)		0.007[-0.001 - 0.015]	0.107
cov(e.Topic1,e.Topic6)		-0.006[-0.013 - 0.001]	0.066
cov(e.Topic1,e.Topic7)		-0.013[-0.019 - -0.007]	0.000
cov(e.Topic1,e.Topic8)		-0.011[-0.018 - -0.004]	0.002
cov(e.Topic2,e.Topic3)		0.037[0.012 - 0.061]	0.003*
cov(e.Topic2,e.Topic4)		0.011[-0.011 - 0.034]	0.363
cov(e.Topic2,e.Topic5)		-0.001[-0.025 - 0.023]	0.923
cov(e.Topic2,e.Topic6)		0.002[-0.018 - 0.023]	0.837
cov(e.Topic2,e.Topic7)		0.021[0.004 - 0.038]	0.015
cov(e.Topic2,e.Topic8)		0.010[-0.012 - 0.032]	0.368
cov(e.Topic3,e.Topic4)		0.026[0.018 - 0.033]	0.000*
cov(e.Topic3,e.Topic5)		0.011[0.003 - 0.018]	0.004*
cov(e.Topic3,e.Topic6)		0.004[-0.003 - 0.010]	0.243
cov(e.Topic3,e.Topic7)		0.002[-0.004 - 0.009]	0.480
cov(e.Topic3,e.Topic8)		0.018[0.011 - 0.025]	0.000*

cov(e.Topic4,e.Topic5)		0.023[0.015 - 0.031]	0.000*
cov(e.Topic4,e.Topic6)		0.014[0.008 - 0.021]	0.000*
cov(e.Topic4,e.Topic7)		0.005[-0.002 - 0.011]	0.141
cov(e.Topic4,e.Topic8)		0.012[0.005 - 0.019]	0.001*
cov(e.Topic5,e.Topic6)		0.019[0.012 - 0.026]	0.000*
cov(e.Topic5,e.Topic7)		0.004[-0.002 - 0.011]	0.197
cov(e.Topic5,e.Topic8)		0.011[0.003 - 0.018]	0.005*
cov(e.Topic6,e.Topic7)		0.028[0.021 - 0.034]	0.000*
cov(e.Topic6,e.Topic8)		0.015[0.008 - 0.021]	0.000*
cov(e.Topic7,e.Topic8)		0.014[0.008 - 0.021]	0.000*

* significant at 95% with positive pathways

Modifying a structural equation model for maximising the completeness of sexuality information provision

The hypothesised model was revised to obtain a refined model, as shown in Figure 2, and the outputs are in Table 4. The model was modified by removing all negative and statistically non-significant pathways from the hypothesized model to improve model fit.

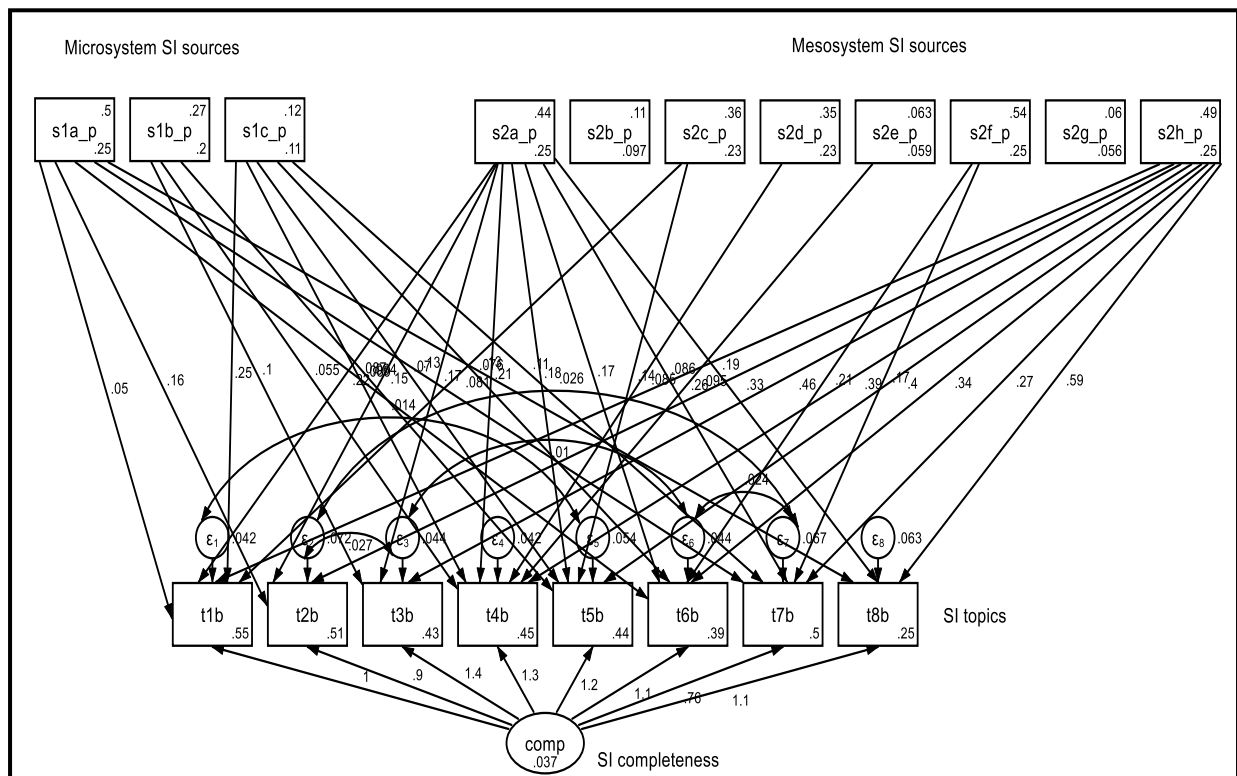


Figure 2. Modified structural equation model for maximising sexuality information completeness

Table 4. Modified structural equation matrix

Variables	Path	Coefficient(β) [CI]	p-value
<i>Topic1</i>	<i>Healthy Relationships</i>		
Biological parents	Biological parents → Topic 1	0.049[0.010 - 0.089]	0.014*
Guardians	Guardian → Topic 1	0.252[0.191-0.314]	0.000*
Friends/confidants	Friends/confidants → Topic 1	0.220[0.172 - 0.267]	0.000*
Teachers	Teachers → Topic 1	0.082[0.037 - 0.124]	0.000*
Books and Recordings	Books and Recordings → Topic 1	0.260[0.214 - 0.307]	0.000*
SI Completeness	Topic 1 → SI Completeness	1	1
<i>Topic2</i>	<i>Sexual values, rights, and responsibilities</i>		
Biological parents	Biological parents→Topic2	0.165[0.125 - 0.205]	0.000*
Friends/confidants	Friends/confidants→Topic2	0.151[0.098 - 0.203]	0.000*
Books and Recordings	Books and Recordings → Topic 2	0.331[0.279 - 0.384]	0.000*
SI Completeness	Topic 2 → SI Completeness	0.917[0.759 - 0.074]	0.000
<i>Topic3</i>	<i>Gender equality and equity</i>		
Siblings	Siblings → Topic3	0.106[.063 - 0.149]	0.000*
Friend/confidants	Friends/confidant → Topic 3	0.167[0.110 - 0.223]	0.000*
Books and (or) Recordings	Books and Recordings → Topic 3	0.460[0.404 - 0.516]	0.000*
SI Completeness	Topic 3 → SI Completeness	1.413[1.236 - 0.590]	0.000
<i>Topic4</i>	<i>Privacy, bodily autonomy, and staying safe</i>		
Siblings	Siblings → Topic 4	0.056[0.007 - 0.104]	0.026
Guardians	Guardians → Topic 4	0.086[.021 - 0.152]	0.010
Friends/confidants	Friends/confidants → Topic 4	0.206[0.150 - 0.261]	0.000*
Religious leaders	Religious leaders → Topic 4	0.083[0.037 - 0.130]	0.000
Community leaders	Community leaders → Topic 4	0.094[0.013 - 0.175]	0.023
Books and Recordings	Book and (or) Recording → Topic 4	0.389[0.335 - 1.442]	0.000*
SI Completeness	Topic 4 → SI Completeness	1.312[1.147 - 1.476]	0.000
<i>Topic5</i>	<i>Communication, decision making, and negotiation</i>		
Siblings	Siblings → Topic 5	0.068[0.0170 - 0.119]	0.009
Guardians	Guardians → Topic 5	0.069[0.001 - 0.138]	0.040
Friends/confidants	Friends/confidants → Topic 5	0.179[0.124 - 0.233]	0.000*
Teachers	Teachers → Topic 5	0.135[0.085 - 0.184]	0.000*
Books and Recordings	Books and Recordings → Topic 5	0.400[0.346- 0.452]	0.000*
SI Completeness	Topic 5 → SI Completeness	1.152[1.018 - 1.286]	0.000
<i>Topic6</i>	<i>Body changes and development</i>		
Biological Parents	Biological Parent → Topic 6	0.089[0.047- 0.130]	0.000
Guardians	Guardians → Topic 6	0.076[.009 - 0.143]	0.026
Friends/confidants	Friends/confidants → Topic 6	0.175[0.124 - 0.226]	0.000*
Healthcare Workers	Healthcare Worker → Topic 6	0.214[0.172 - 0.256]	0.000*

Books and Recordings	Books and Recordings → Topic 6	0.341[0.292 - 0.391]	0.000*
SI Completeness	Topic 6 → SI Completeness	1.083[0.930 - 1.236]	0.000
<i>Topic7</i>	<i>Pregnancy, HIV and STIs</i>		
Biological parents	Biological parents → Topic 7	0.125[0.079 - 0.171]	0.000*
Guardians	Guardians → Topic 7	0.108[0.042 - 0.174]	0.001*
Friend/confidants	Friend/confidant → Topic 7	0.086[0.035 - 0.137]	0.001
Healthcare Workers	Healthcare Worker ss→ Topic 7	0.173[0.129 - 0.216]	0.000*
Books and Recordings	Books and Recordings → Topic 7	0.270[0.220 - 0.319]	0.000*
SI Completeness	Topic 7 → SI Completeness	0.760[0.612 - 0.907]	0.000
<i>Topic8</i>	<i>Sex, sexual expression, cycle, and response</i>		
Biological parents	Biological parent → Topic 8	0.134[0.088 - 0.179]	0.000*
Friends/confidants	Friend/confidant → Topic 8	0.187[0.132 - 0.242]	0.000*
Books and Recordings	Book and Recording → Topic 8	0.587[0.533 - 0.642]	0.000*
SI Completeness	Topic 8 → SI Completeness	1.117[.952 -1.281]	0.000
Var (e. Topic 1)		0.042	
Var (e. Topic 2)		0.070	
Var (e. Topic 3)		0.043	
Var (e. Topic 4)		0.042	
Var (e. Topic 5)		0.054	
Var (e. Topic6)		0.045	
Var (e. Topic7)		0.067	
Var (e. Topic8)		0.063	
Var (SI Completeness)		0.037	
Cov (e. Topic 1, e. Topic 5)		0.014[0.009 - 0.019]	0.000
Cov (e. Topic 2, e. Topic 3)		0.025[0.019 - 0.031]	0.000
Cov (e. Topic 2, e. Topic5)		-0.004[-0.008 - -0.001]	0.008
Cov (e. Topic2, e. Topic7)		0.025[0.020 - 0.031]	0.000
Cov (e. Topic 3, e. Topic6)		-0.010[-0.020 - 0.000]	0.000
Cov (e. Topic 6, e. Topic7)		0.024[0.019 - 0.030]	0.000

***A significant pathway with $\beta > 0.1$, per sexuality information topic**

The structural equation model demonstrated that multiple sources of sexuality information were significantly associated with completeness across the eight sexuality domains.

Topic 1: Healthy relationships had significant associates, including guardians ($\beta = 0.252$, 95% CI 0.191–0.314, $p < 0.001$), friends/confidants ($\beta = 0.220$, 95% CI 0.172–0.267, $p < 0.001$), and books and recordings ($\beta = 0.260$, 95% CI 0.214–0.307, $p < 0.001$). Teachers ($\beta = 0.082$, p

< 0.001) and biological parents ($\beta = 0.049$, $p = 0.014$) had smaller but statistically significant effects.

For Topic 2: Sexual values, rights, and responsibilities, Books and recordings had the strongest association ($\beta = 0.331$, 95% CI 0.279–0.384, $p < 0.001$), followed by biological parents ($\beta = 0.165$, $p < 0.001$) and friends/confidants ($\beta = 0.151$, $p < 0.001$). Topic 3: Gender equality and equity. Books and recordings showed a very strong association ($\beta = 0.460$, 95% CI 0.404–0.516, $p < 0.001$), exceeding that of friends/confidants ($\beta = 0.167$, $p < 0.001$) and siblings ($\beta = 0.106$, $p < 0.001$).

Topic 4: Privacy, bodily autonomy, and safety had Friends/confidants ($\beta = 0.206$, $p < 0.001$) and books and recordings ($\beta = 0.389$, $p < 0.001$) as significant associates. Guardians, religious leaders, and community leaders were also modest but significant associates.

The Topic 5: Communication, decision-making, and negotiation also had Books and recordings as the strongest associate ($\beta = 0.400$, 95% CI 0.346–0.452, $p < 0.001$), followed by friends/confidants ($\beta = 0.179$, $p < 0.001$) and teachers ($\beta = 0.135$, $p < 0.001$). Siblings and guardians contributed a smaller but significant association.

The Topic 6: Body changes and development had healthcare workers ($\beta = 0.214$, $p < 0.001$) and books and recordings ($\beta = 0.341$, $p < 0.001$) as the strongest associates. While Topic 7: Pregnancy, HIV and STIs, had books and recordings ($\beta = 0.270$, $p < 0.001$) and healthcare workers ($\beta = 0.173$, $p < 0.001$) as key associates, alongside biological parents and guardians.

Topic 8: Sexual expression, cycle, and response. The strongest association for Topic 8: Sexual expression, cycle, and response was observed for books and recordings ($\beta = 0.587$, 95% CI 0.533–0.642, $p < 0.001$), followed by friends/confidants ($\beta = 0.187$, $p < 0.001$) and biological parents ($\beta = 0.134$, $p < 0.001$).

Across topics, all sexuality topics were significantly associated with the overall sexuality information completeness, with the strongest effects observed for gender equality ($\beta = 1.413$) and violence prevention and safety ($\beta = 1.312$).

Residual variances were relatively low across topics (0.042–0.070), indicating acceptable model stability. Significant covariance was observed between several domains, including healthy relationships and communication skills ($\beta = 0.014$, $p < 0.001$), suggesting interrelated learning pathways. Negative covariance between sexual values and communication ($\beta = -0.004$, $p = 0.008$) and between gender equality and body changes ($\beta = -0.010$, $p < 0.001$) indicates potential content or contextual trade-offs.

The likelihood ratio test comparing the specified model to the saturated model was statistically significant ($\chi^2(67) = 360.36$, $p < 0.001$). Although significant chi-square values are common in large samples, this result suggests some deviation from a perfect fit but does not necessarily indicate poor model adequacy. The baseline model comparison was also significant ($\chi^2(116) = 4522.57$, $p < 0.001$), confirming that the proposed model provided a substantially better fit than the null model.

The root mean square error of approximation (RMSEA) was 0.061 (90% CI: 0.051–0.070), indicating a reasonable and acceptable level of approximation error. Although the p-close value was 0.031, suggesting the RMSEA was slightly above the ideal threshold of 0.05, the confidence interval remained within acceptable limits, supporting model adequacy.

Post estimation statistics of the modified model

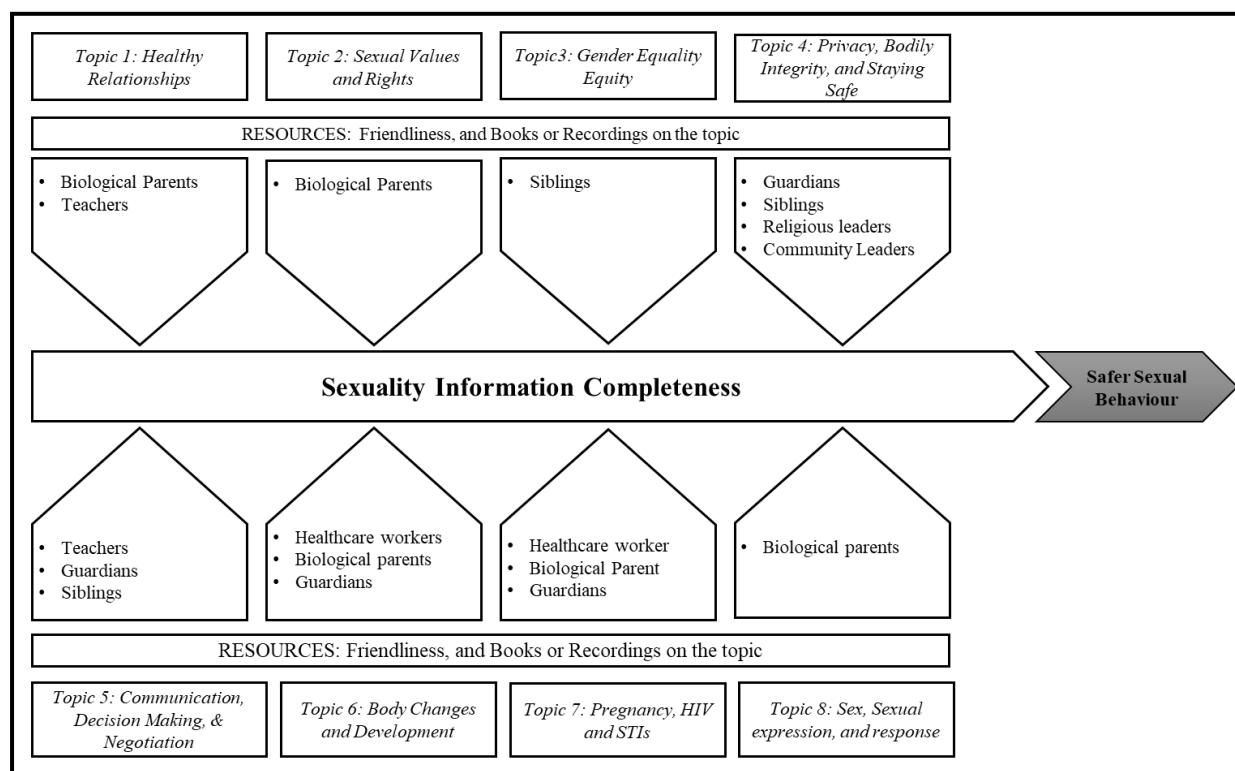
Fit statistic	Value	Description
<i>Likelihood ratio</i>		
chi2_ms(67)	360.359	model vs. saturated
p > chi2	0	
chi2_bs(116)	4522.568	baseline vs. saturated
p > chi2	0	
<i>Population error</i>		
RMSEA	0.061	Root mean squared error of approximation
90% CI, lower bound	0.051	
upper bound	0.07	
pclose	0.031	Probability RMSEA ≤ 0.05
<i>Information criteria</i>		
AIC	5386.218	Akaike's information criterion
BIC	5629.476	Bayesian information criterion
<i>Baseline comparison</i>		
CFI	0.968	Comparative fit index
TLI	0.945	Tucker–Lewis index
<i>Size of residuals</i>		
SRMR	0.069	Standardized root mean squared residual
CD	0.954	Coefficient of determination

The incremental fit indices further confirmed strong model performance. The comparative fit index (CFI) was 0.968 and the Tucker–Lewis index (TLI) was 0.945, both exceeding the recommended cutoff of 0.90 and approaching the more stringent threshold of 0.95. These values indicate that the model substantially improved fit relative to the baseline model.

The standardized root means square residual (SRMR) was 0.069, which falls below the recommended cutoff of 0.08, suggesting acceptable residual error and good correspondence between observed and predicted correlations. The information criteria (AIC = 5386.22; BIC = 5629.48) provide useful benchmarks for model comparison and suggest an optimal balance between model fitness and parsimony. The coefficient of determination (CD = 0.954) indicated that approximately 95.4% of the variance in sexuality information completeness and related constructs was explained by the model, demonstrating strong explanatory power.

The structural equation model demonstrated good overall fit to the data. The RMSEA was 0.061 (90% CI: 0.051–0.070, $p_{close} = 0.031$), indicating acceptable approximation to the population covariance matrix. Comparative fit indices were high, with CFI = 0.968 and TLI = 0.945, while residual-based indices also reflected good fit (SRMR = 0.048, CD = 0.966). Together, these results indicate that the model provides a reliable representation of the relationships among the observed and latent variables. Overall, these statistics demonstrate that the model provides a good representation of the underlying data structure.

Model Application



The P-fosi Model is designed to maximize completeness by recognising that young people prefer different sources of sexuality information depending on the subject matter. At the centre of the model are the eight topics of sexuality information that were mapped to particular sources, which young people consistently preferred.

Biological parents and guardians emerged as the most trusted and reliable sources across many domains, particularly for topics such as relationships, values, body changes, pregnancy, and sexual expression. Siblings, friends, and confidants were also valued, particularly for discussions on relationships and gender equity, where relatability and shared experience were important. Teachers and healthcare workers were strongly preferred for topics on body development, pregnancy, HIV, and STIs. Religious leaders played an important role in shaping discussions about values, privacy, and morality, while books and recordings were preferred across the eight topics. In contrast, peers were consistently the least preferred source of sexuality information.

In practice, this model calls for a layered delivery system where parents provide foundational guidance, schools and healthcare workers deliver structured factual knowledge, religious leaders reinforce moral and ethical aspects, and media resources supplement private and sensitive learning needs. By acknowledging age, gender, and contextual differences, the model ensures that sexuality information is not only accurate and inclusive but also accessible, acceptable, and complete.

Discussion of findings

This study proposes a sexuality information provision model that aligns young people's preferred sources with all sexuality information topics to maximise completeness and support safer sexual behaviour among young people in Uganda's island communities. The findings offer both conceptual and methodological advances by demonstrating that the effectiveness of sexuality information depends not only on exposure but also on the completeness of information and its alignment with trusted sources.

Findings show that young people continue to receive information primarily from accessible rather than preferred or trusted sources, even when initiatives have expanded access to sexuality education (23–26). The persistent and substantial gaps between actual and preferred sources suggest that sexuality information provision systems are structurally misaligned. Rather than functioning as integrated systems, current information environments appear segmented, with different actors addressing selected topics in isolation (27–29). Recent evidence highlighting the importance of coordinated, multi-level approaches to sexuality education (2,23,27,30). Some of these domains are often underemphasised in formal sexuality education despite their strong relevance to sexual behaviour (31–35). This fragmentation undermines comprehension, motivation, and the translation of knowledge into safer sexual behaviour. It also shifts the concept of monitoring and evaluation frameworks on sexuality education to move from mere access to dimensions of comprehensiveness, such as completeness of sexuality information across all eight topics

A key theoretical contribution of this study is the identification of source–topic alignment as a critical but overlooked determinant of quality sexuality education. Young people do not perceive sexuality information sources as interchangeable. Instead, they associate different sources with credibility, confidentiality, and social acceptability depending on the topic. Studies such as that of Bouclaous et al. only studied sources of sexuality information without interrogating the available and preferred sources of sexuality information and aligning them to the topics (36). Misalignment between content and trusted sources contributes to avoidance, misinformation, and incomplete understanding. This finding extends the IMB framework by emphasising relational trust as a structural determinant of motivation and behavioural competence (22). This research emphasises that trust and relational dynamics with the sources

shape young people's willingness to engage with sexuality information and apply it in real-life decision-making.

The integrated framework combining bioecological and social learning perspectives helps explain why alignment matters. Learning occurs across interconnected systems, and the credibility and proximity of sources influence attention, retention, and behavioural modelling (20,21,37). The strong influence of parents, peers, and trusted adults across domains reflects the importance of relational learning environments, particularly in contexts where formal education is constrained (27,34,38). These findings support growing calls for ecological and whole-system sexuality education approaches that integrate families, communities, and health systems (39,40).

The strong predictive role of books and recordings highlights the potential of credible, structured, and revisitable media. Young people appear to value privacy, flexibility, and the ability to engage with sensitive content at their own pace. This finding aligns with recent evidence showing that digital and media-based interventions can increase access, acceptability, and engagement among adolescents, particularly in underserved and conservative settings (28,41). However, the extremely low utilisation of these media in practice suggests significant structural barriers, including access, distribution, and digital inequities. This is coupled with the claims of misinformation from many digital (3). These findings reinforce the importance of combining curated media with supportive interpersonal facilitation from parents, teachers, and health providers.

Island and fishing communities represent structurally marginalised contexts characterised by geographic isolation, mobility, and limited access to formal services. The relevance of this study extends beyond Uganda to similar populations globally, including remote, migrant, and

humanitarian settings. In such contexts, strengthening completeness requires system-level alignment and coordinated delivery rather than reliance on single platforms. Recent literature highlights the importance of adaptive and context-sensitive sexuality education for mobile and hard-to-reach populations (42,43).

The findings suggest the need for a paradigm shift in sexuality education policy and programming. First, interventions should prioritise alignment between content domains and trusted sources instead of relying predominantly on school-based delivery. Second, structured parent and caregiver engagement should be strengthened through culturally appropriate training and communication tools. Evidence consistently shows that parent–adolescent communication is protective but constrained by taboos, limited skills, and discomfort (44–46). Third, healthcare workers should be more fully integrated into community-based sexuality education systems, especially for biomedical topics. Fourth, investments in credible, locally adapted media and digital content should be scaled to enhance reach, consistency, and equity. Such layered and coordinated approaches are increasingly recognised as effective in improving sexual health outcomes(2,47).

Although peers strongly shape norms and behaviour, they were less preferred as authoritative sources for structured learning. This dual role is consistent with recent research showing that peers influence attitudes and behaviours but may also contribute to misinformation unless adequately trained and supported (48–51). Residual covariances in the structural model likely reflect these informal transmission pathways and unobserved contextual influences, underscoring the importance of structured peer education models embedded within broader systems.

The implications of this study are relevant for policymakers, educators, health practitioners, curriculum developers, NGOs, and community leaders. Their insights can guide the adoption of the P-fosi model. Implemented effectively, the P-fosi could support more relevant interventions, strengthen decision-making among youth, and reshape how organizations think about programming for sexuality information provision, especially in geographically isolated communities such as islands, rural areas, and other hard-to-reach settings.

This study provides robust quantitative modelling and ecological analysis in a historically under-researched population. The use of structural equation modelling enabled the identification of complex pathways linking preferred sources to completeness, offering a novel analytical framework for sexuality education research. However, the cross-sectional design limits causal inference, and reliance on self-reported measures may introduce reporting bias.

Future research should examine longitudinal relationships between completeness and behavioural outcomes, test alignment-based intervention models, and evaluate the scalability of media-supported approaches in diverse contexts. Further work should also explore the role of digital ecosystems, cultural norms, and structural inequalities in shaping sexuality information environments.

Conclusion

This study shows that completeness of information and alignment with trusted and preferred sources are critical determinants of safer sexual behaviour. Young people in Uganda's island communities receive fragmented information across key domains, reflecting systemic misalignment rather than simple access gaps. By operationalising completeness across all sexuality information topics and identifying source–topic alignment as a structural driver of learning quality, this study introduces a novel and practical framework. The findings highlight

the importance of combining Books and recordings as private, structured media, with trusted interpersonal sources such as parents, healthcare workers, and teachers through coordinated, multi-source systems. The results call for a shift from access-driven to quality- and alignment-driven sexuality education, offering actionable guidance to improve equity and effectiveness, particularly in underserved and mobile populations.

Acknowledgements

I also thank the respondents who took the time and effort to take my surveys, Key Informant Interviews and Focused Group Discussions.

Authors' contributions

Venantius Bbaale Kirwana conceptualized the study, collected and analysed the data, interpreted the results, and wrote the manuscript. Dr. Allen Kabagenyi, Dr. Patricia Ndugga, Dr. Cyprian Misinde, , Dr. Christian Kakuba, and Dr. Stephen Wandera contributed to writing, interpretation of results and proofreading the manuscript. All authors read and approved the final manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Declaration

Ethics approval and consent to participate.

The surveys were conducted according to established ethical guidelines, and informed consent was obtained from the participants in the online surveys as well as the formative field work. The study was approved by the TASO Institutional Review Board, Uganda National Council of Science and Technology, permit number SS3785ES.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

REFERENCES

1. WHO. Update to WHO implementation guidance TECHNICAL BRIEF Differentiated and simplified pre-exposure prophylaxis for HIV prevention [Internet]. 2022. Available from: <http://apps.who.int/bookorders>.
2. Siddiqui M, Kataria I, Watson K, Chandra-Mouli V. A systematic review of the evidence on peer education programmes for promoting the sexual and reproductive health of young people in India. *Sexual and Reproductive Health Matters*. Taylor and Francis Ltd.; 2020. doi:10.1080/26410397.2020.1741494 PubMed PMID: 32372723.
3. Kirwana VB, Misinde C, Ndugga P, Kakuba C. Factors associated with and barriers to completeness of sexuality information among young people in the Island Communities of Uganda. 2025.
4. UNFPA. State of World Population 2021. 2021. Report.
5. UNESCO. The journey towards comprehensive sexuality education Global status report [Internet]. 2021. Available from: <http://www.unesco.org/open-access/terms-use-ccbysa-en>
6. Ninsiima AB, Leye E, Michielsen K, Kemigisha E, Nyakato VN, Coene G. “Girls have more challenges; they need to be locked up”: A qualitative study of gender norms and the sexuality of young adolescents in Uganda. *Int J Environ Res Public Health*. 2018;15(2). doi:10.3390/ijerph15020193 PubMed PMID: 29364192.
7. Achen D, Fernandes D, Kemigisha E, Rukundo GZ, Nyakato VN, Coene G. Trends and Challenges in Comprehensive Sex Education (CSE) Research in Sub-Saharan Africa: a Narrative Review. *Current Sexual Health Reports*. Springer; 2024. p. 221–9. doi:10.1007/s11930-023-00362-1

8. UBOS. National Population and Housing Census 2024 Final Report Volume 1 (Main) Republic of Uganda [Internet]. 2024 [cited 2025 Mar 12]. Report. Available from: <https://www.ubos.org/wp-content/uploads/2024/12/National-Population-and-Housing-Census-2024-Final-Report-Volume-1-Main.pdf>
9. Byansi W, Howell TH, Filiatreau LM, Nabunya P, Kaiser N, Kasson E, et al. Sexual Health Behaviors and Knowledge Among Ugandan Adolescent Girls: Implications for Advancing Comprehensive Sexual Health Education Technology. *Child Youth Care Forum*. 2023 Dec 1;52(6):1227–47. doi:10.1007/s10566-023-09730-3
10. Schneider M, Hirsch JS. Comprehensive Sexuality Education as a Primary Prevention Strategy for Sexual Violence Perpetration. *Trauma, Violence, and Abuse*. SAGE Publications Ltd; 2020. p. 439–55. doi:10.1177/1524838018772855 PubMed PMID: 29720047.
11. Kemigisha E, Ivanova O, Ruzaaza GN, Ninsiima AB, Kaziga R, Bruce K, et al. Process evaluation of a comprehensive sexuality education intervention in primary schools in South Western Uganda. *Sexual & Reproductive Healthcare*. 2019;21:51–9. doi:<https://doi.org/10.1016/j.srhc.2019.06.006>
12. Nanyonjo G, Asiki G, Ssetaala A, Nakaweesa T, Wambuzi M, Nanvubya A, et al. Prevalence and correlates of hiv infection among adolescents and young people living in fishing populations along lake victoria fishing communities in uganda. *Pan African Medical Journal*. 2020;37(208):1–12. doi:10.11604/pamj.2020.37.208.26124 PubMed PMID: 33505576.
13. Kwiringira JN, Mugisha J, Akugizibwe M, Ariho P. ‘When will the doctor be around so that I come by?!’ Geo-socio effects on health care supply, access and utilisation:

- experiences from Kalangala Islands, Uganda. *BMC Health Serv Res.* 2021 Dec 1;21(1). doi:10.1186/s12913-021-07204-7 PubMed PMID: 34702272.
14. Agyei FB, Kaura DK, Bell JD. Parent-adolescent sexual and reproductive health information communication in Ghana. *Reproductive Health* . 2025 Dec 1;22(1). doi:10.1186/s12978-025-01961-y PubMed PMID: 39972503.
 15. Othman A, Shaheen A, Otoum M, Aldiqs M, Hamad I, Dabobe M, et al. Parent–child communication about sexual and reproductive health: perspectives of Jordanian and Syrian parents. *Sex Reprod Health Matters.* 2020;28(1). doi:10.1080/26410397.2020.1758444 PubMed PMID: 32425136.
 16. Ndugga P, Kwagala B, Wandera SO, Kisaakye P, Mbonye MK, Ngabirano F. “If your mother does not teach you, the world will...”: a qualitative study of parent-adolescent communication on sexual and reproductive health issues in Border districts of eastern Uganda. *BMC Public Health.* 2023 Dec 1;23(1). doi:10.1186/s12889-023-15562-6 PubMed PMID: 37041536.
 17. UNESCO. International technical guidance on sexuality education. United Nations Educational Scientific and Cultural Organization SDGs [Internet]. 2018. 1–139 p. Available from: <http://unesdoc.unesco.org/images/0026/002607/260770e.pdf> doi:10.1523/JNEUROSCI.0529-04.2004
 18. Kyegombe N, Meiksin R, Wamoyi J, Heise L, Stoebenau K, Buller AM. Sexual health of adolescent girls and young women in Central Uganda: exploring perceived coercive aspects of transactional sex. *Sex Reprod Health Matters.* 2020 Jan 1;28(1). doi:10.1080/26410397.2019.1700770 PubMed PMID: 31934824.

19. Sidze EM, Stillman M, Keogh S, Mulupi S, Egesa CP, Leong E, et al. From Paper to Practice: Sexuality Education Policies and Their Implementation in Kenya [Internet]. 2017. Report. Available from: <https://www.guttmacher.org/report/sexuality-education-kenya>.
20. Bronfenbrenner U. Contexts of child rearing: Problems and prospects. *American psychologist*. 1979;34(10):844.
21. Bandura A. *Social learning theory*. Englewood Cliffs. 1977.
22. Fisher JD. Changing AIDS-Risk Behavior [Internet]. 1992. Report. Available from: https://opencommons.uconn.edu/chip_docs
23. Chavula MP, Zulu JM, Hurtig AK. Factors influencing the integration of comprehensive sexuality education into educational systems in low- and middle-income countries: a systematic review. *Reproductive Health*. BioMed Central Ltd; 2022. doi:10.1186/s12978-022-01504-9 PubMed PMID: 36175901.
24. Ketting E, Friele M, Michielsen K. Evaluation of holistic sexuality education: A European expert group consensus agreement. *The European Journal of Contraception & Reproductive Health Care*. 2016 Jan 2;21(1):68–80. doi:10.3109/13625187.2015.1050715
25. Leung H, Shek DTL, Leung E, Shek EYW. Development of contextually-relevant sexuality education: Lessons from a comprehensive review of adolescent sexuality education across cultures. *International Journal of Environmental Research and Public Health*. MDPI; 2019. doi:10.3390/ijerph16040621 PubMed PMID: 30791604.

26. UNESCO. The journey towards comprehensive sexuality education Global status report [Internet]. 2021. Available from: <http://www.unesco.org/open-access/terms-use-ccbysa-en>
27. Shibuya F, Estrada CA, Sari DP, Takeuchi R, Sasaki H, Warnaini C, et al. Teachers' conflicts in implementing comprehensive sexuality education: a qualitative systematic review and meta-synthesis. *Tropical Medicine and Health*. BioMed Central Ltd; 2023. doi:10.1186/s41182-023-00508-w
28. Ngabaza S. Parents resist sexuality education through digital activism. *Journal of Education (South Africa)*. 2022;(89):84–104. doi:10.17159/2520-9868/i89a05
29. de Haas B, Hutter I. Teachers' personal experiences of sexual initiation motivating their sexuality education messages in secondary schools in Kampala, Uganda. *Sex Educ*. 2022;22(2):138–52. doi:10.1080/14681811.2021.1898360
30. Chandra-Mouli V, Lane C, Wong S. What does not work in adolescent sexual and reproductive health: A review of evidence on interventions commonly accepted as best practices. *Global Health Science and Practice*. Johns Hopkins University Press; 2015. p. 333–40. doi:10.9745/GHSP-D-15-00126 PubMed PMID: 26374795.
31. Bweyale J, Sekaye NA. 'Do Not Separate Sexuality Education from Religious Teachings': Parents' Perceptions and Suggestions towards Sexuality Education in Uganda. *East African Journal of Traditions, Culture and Religion*. 2023 Mar 28;6(1):16–39. doi:10.37284/eajtr.6.1.1148
32. Moore E V., Hirsch JS, Spindler E, Nalugoda F, Santelli JS. Debating Sex and Sovereignty: Uganda's New National Sexuality Education Policy. *Sexuality Research and Social Policy*. 2022 Jun 1;19(2):678–88. doi:10.1007/s13178-021-00584-9

33. Ninsiima AB, Coene G, Michielsens K, Najjuka S, Kemigisha E, Ruzaaza GN, et al. Institutional and contextual obstacles to sexuality education policy implementation in Uganda. *Sex Educ.* 2020 Jan 2;20(1):17–32. doi:10.1080/14681811.2019.1609437
34. de Haas B, Hutter I. Teachers’ conflicting cultural schemas of teaching comprehensive school-based sexuality education in Kampala, Uganda. *Cult Health Sex.* 2019;21(2):233–47. doi:10.1080/13691058.2018.1463455 PubMed PMID: 29737926.
35. De Haas B, Hutter I. Teachers’ professional identities in the context of school-based sexuality education in Uganda—a qualitative study. *Health Educ Res.* 2020;35(6):553–63.
36. Bouclaous CH, Alrazim A, Chababi J, Jamaledine W, Nassar E, Maalouf A, et al. Association between sources of sexuality education, sexual beliefs and behaviours in Lebanese young adults: a university-based cross-sectional study. *Sex Educ.* 2021 Jan 2;21(1):1–12. doi:10.1080/14681811.2020.1722624
37. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* 1977;84(2):191.
38. Achora S, Thupayagale-Tshweneagae G, Akpor OA, Mashalla YJS. Perceptions of adolescents and teachers on school-based sexuality education in rural primary schools in Uganda. *Sexual & Reproductive Healthcare.* 2018;17:12–8.
39. Mbizvo MT, Kasonda K, Muntalima NC, Rosen JG, Inambwae S, Namukonda ES, et al. Comprehensive sexuality education linked to sexual and reproductive health services reduces early and unintended pregnancies among in-school adolescent girls in Zambia. *BMC Public Health.* 2023 Dec 1;23(1). doi:10.1186/s12889-023-15023-0 PubMed PMID: 36797703.

40. Chavula MP, Zulu JM, Hurtig AK. Factors influencing the integration of comprehensive sexuality education into educational systems in low- and middle-income countries: a systematic review. *Reproductive Health*. BioMed Central Ltd; 2022. doi:10.1186/s12978-022-01504-9 PubMed PMID: 36175901.
41. Olamijuwon E, Odimegwu C. Sexuality Education in the Digital Age: Modelling the Predictors of Acceptance and Behavioural Intention to Access and Interact with Sexuality Information on Social Media. *Sexuality Research and Social Policy*. 2022 Sep 1;19(3):1241–54. doi:10.1007/s13178-021-00619-1
42. Wandera SO, Tumwesigye NM, Walakira EJ, Kisaakye P, Wagman J. Alcohol use, intimate partner violence, and HIV sexual risk behavior among young people in fishing communities of Lake Victoria, Uganda. *BMC Public Health*. 2021 Dec 1;21(1). doi:10.1186/s12889-021-10595-1 PubMed PMID: 33740935.
43. Ivanova O, Rai M, Mlahagwa W, Tumuhairwe J, Bakuli A, Nyakato VN, et al. A cross-sectional mixed-methods study of sexual and reproductive health knowledge, experiences and access to services among refugee adolescent girls in the Nakivale refugee settlement, Uganda. *Reprod Health*. 2019;16(1):1–11. doi:10.1186/s12978-019-0698-5 PubMed PMID: 30890170.
44. Kisaakye P, Ndugga P, Kwagala E, Kayitale Mbonye M, Ngabirano F, Ojiambo Wandera S. Parent–child communication on sexual and reproductive health in border districts of Eastern Uganda. *Sex Educ*. 2024;24(1):125–37. doi:10.1080/14681811.2022.2135500
45. Ndugga P, Kwagala B, Wandera SO, Kisaakye P, Mbonye MK, Ngabirano F. “If your mother does not teach you, the world will...”: A qualitative study of parent-adolescent

- communication on sexual and reproductive health issues in Border districts of eastern Uganda [Internet]. 2022. doi:10.21203/rs.3.rs-2179438/v1
46. Usonwu I, Ahmad R, Curtis-Tyler K. Parent–adolescent communication on adolescent sexual and reproductive health in sub-Saharan Africa: a qualitative review and thematic synthesis. *Reprod Health*. 2021;18(1):1–15. doi:10.1186/s12978-021-01246-0 PubMed PMID: 34629082.
 47. Akila D, Oluwasegun A, Bose K, Omotoso O, Adefila A, Mwaikambo L. Improving the Quality of Adolescent and Youth-Friendly Health Services Through Integrated Supportive Supervision in Four Nigerian States Key Findings [Internet]. 2024. Report. Available from: www.ghspjournal.org
 48. Clark DA, Durbin CE, Heitzeg MM, Iacono WG, McGue M, Hicks BM. Adolescent Sexual Development and Peer Groups: Reciprocal Associations and Shared Genetic and Environmental Influences. *Arch Sex Behav*. 2021 Jan 1;50(1):141–60. doi:10.1007/s10508-020-01697-9 PubMed PMID: 32314108.
 49. Widman L, Choukas-Bradley S, Noar SM, Nesi J, Garrett K. Parent-Adolescent Sexual Communication and Adolescent Safer Sex Behavior: A Meta-Analysis. *JAMA Pediatr*. 2016;170(1):52–61. doi:10.1001/jamapediatrics.2015.2731
 50. Hartikainen H, Razi A, Wisniewski P. Safe Sexting: The Advice and Support Adolescents Receive from Peers Regarding Online Sexual Risks. *Proc ACM Hum Comput Interact*. 2021 Apr 22;5(CSCW1). doi:10.1145/3449116
 51. Hensen B, Floyd S, Phiri MM, Schaap A, Sigande L, Simuyaba M, et al. The impact of community-based, peer-led sexual and reproductive health services on knowledge of HIV status among adolescents and young people aged 15 to 24 in Lusaka, Zambia: The

Yathu Yathu cluster-randomised trial. PLoS Med. 2023 Apr 1;20(4):e1004203.
doi:10.1371/journal.pmed.1004203 PubMed PMID: 37083700.