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Frequency and importance of interpersonal communication about a school-based intervention with parents, peers, and teachers: application of social interface model

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ABSTRACT

Social interface model (SIM) explicates the important roles of family, peer, and school microsystems in intervention research. The present study used surveys to explore how Nicaraguan adolescents who participated in a school-based substance use and violence prevention intervention communicated about the intervention with parents, peers, and teachers. Latent class analysis was run to identify distinctive typologies of interfaces characterized by occurrence and importance of conversations. Five latent classes ($N = 109$) were discovered: *optimal transference* (21%), *neutral transference* (17%), *limited positive transference* (17%), *negligible neutral interface* (28%), and *negligible adverse interface* (16%). The optimal transference and neutral transference groups reported having conversations with all three microsystems (i.e. their mother, father, best friend, and teachers) and that those conversations resulted in seeing the curriculum the same way or as more important. The negligible neutral interface and negligible adverse interface groups reported minimal or no conversation across microsystems, which resulted in viewing the curriculum as not important or less important. The limited positive transference group reported selective conversations mostly with their mother and teachers, which was evaluated as important and/or neutral. Findings discuss the application of SIM in prevention research and provide a more nuanced understanding of how intervention messages are recalled and processed post-delivery.

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People live within a diverse social ecology. They interact among family, school, peer, church, work, and recreational contexts and each of these contexts can influence how people interpret information and experiences from other contexts. In particular, intervention messages aimed at changing specific attitudes, beliefs or behaviors are often communicated to groups and individuals within one particular social context, yet the behaviors or outcomes those intervention messages target do not always occur in that same social context. Consider, for example, an intervention that seeks to deter adolescent drug use. The intervention messages may be communicated to

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children at school with the goal of equipping them with the ability and efficacy to refuse drugs in social contexts after school, not during the class. This example illustrates that intervention messages often migrate with a person from one context to another; however, intervention research has rarely theorized the ways that two or more social systems may interface with each other to influence intervention messages after the intervention delivery.

Social interface model (SIM: Pettigrew et al., 2018) was developed to theorizie how intervention messages are used, modified, or disregarded after they are delivered. SIM is framed within a socioecological model (Bronfenbrenner & Morris, 2006) and considers how two microsystems, within broader macrosystems, may interface at a mesosystem level to influence intervention messages and subsequent outcomes. SIM is based on the premise that intervention message outcomes are both a function of message aspects and how the message is adopted and adapted post-delivery as it is brought into other life-contexts. The present study aims to apply SIM in prevention research and provide a more nuanced understanding of how intervention messages are recalled and processed after the intervention delivery. More specifically, this study explores how adolescents who participated in a school-based substance use and violence prevention intervention communicated about the intervention with parents, peers, and teachers.

The following paragraphs provide an overview of SIM, the specific processes that occur in each microsystem, and the four possible ways messages might be adopted or adapted in a mesosystem composed of two interfacing microsystems.

The microsystem

The model begins with the microsystem – the immediate context into which intervention messages are communicated. Interventions, by nature, call for some form of behavior change, and enactment of such behaviors are, in part, dependent on the message content and the delivery of the message. Importantly, SIM proposes that messages do not stand apart from other aspects of microsystems, and instead, become embedded and integrated into microsystems. Furthermore, SIM draws upon Rogers's (2003) diffusion of innovation theory to identify factors affecting adoption rates of intervention messages, including the messages' compatibility with present behaviors, relative advantage over other behaviors, complexity, trialability, and observability. Similarly, message characteristics offered by Southwell (2013), such as emotional appeals, narrativity, and rhetorical structure, may also affect how intervention messages enter and assimilate into a microsystem.

Other factors beyond the content of the message and its delivery affect whether people adopt intervention messages. For example, Pettigrew et al. (2018) suggest individuals' psychological and biological factors affect if and how messages are received and subsequently enacted. Static (e.g. genetics, language fluency, hearing ability, and developmental state) or dynamic (e.g. motivation, tiredness, and attentiveness) biological factors can influence message reception. Likewise, psychological factors affecting message reception and enactment can also be further sub-categorized between stable traits and temporal states. Prior research has shown that stable individual characteristics such as favorable views of change, better coping abilities when facing uncertainty, and

belief in control over one's destiny are associated with early adoption of innovations (Rogers, 2003). Temporal states affecting one's adoption of intervention messages are presented in UNICEF's (2012) HIC-DARM model, which posits that individuals move through a series of psychological states regarding intervention messages (e.g. becoming convinced to adopt a new behavior, enacting the behavior, and having the behavior reinforced and maintained).

According to SIM, social factors are a third component affecting how intervention messages are received at the microsystem level. A person's social role within a microsystem may influence adoption of behavior change. Cultural norms and social hierarchies will also determine the degree to which members decide to act upon intervention messages. Also warranting consideration are the current and past discourses surrounding the intervention behaviors, as well as competing messages within the social system that may contradict or challenge an intervention's messages.

Together, message factors such as content and delivery, individual factors related to psychological and biological states and traits, and social factors such as norms and discourses, predict the extent to which intervention messages are adopted and new behaviors are subsequently enacted, reinforced, and maintained. Importantly, SIM advances that these processes occur both in the microsystem in which the intervention message is originally communicated and also the recipients' other microsystems (e.g. family or work contexts). That is, when someone brings an intervention message with them into a different microsystem from where the intervention was communicated, the message is again subjected to message factors, social factors, and individual factors. An anti-smoking intervention, for example, may be communicated at a child's school and the child may adopt the message; however, the same message may not fare equally as well when imported into the child's family microsystem if their parents are both lifelong smokers.

The macrosystem

SIM (Pettigrew et al., 2018) also considers the influence of the broader macrosystem in which microsystems and mesosystems exist. Macrosystems contribute to the physical environment in which actors participate in various microsystems (Bronfenbrenner & Morris, 2006). For example, rural communities may have less access to certain healthcare facilities, which may in turn change how intervention messages are enacted. Bennett and colleagues (2008) demonstrated this possibility showing that intervention messages about healthy dietary choices could not be fully implemented at home due to a lack of available healthy food options. When a macrosystem's structural affordances fail to support intervention messages, changes may occur in attitude or behavioral intention, but not in actual health behaviors (e.g. Grimshaw et al., 2014). When a macrosystem contributes to a supportive environment for intervention messages to be enacted, positive results can occur. For example, Hamilton and colleagues (2005) successfully reduced tobacco harm through an intervention that altered the macrosystem by providing school nurse trainings and supportive school policies.

Having overviewed how intervention messages exist in microsystems that are influenced by the macrosystems in which they exist, we can now turn to SIM's core: the mesosystem.

The mesosystem

The mesosystem is an important but undertheorized and understudied environment that can potentially influence intervention outcomes. Interventions can be extended via the interpersonal interactions that people have regarding the intervention in the various microsystems in which they live. As reviewed by Pettigrew and colleagues (2018), research has shown that substance use interventions occurring in one microsystem (e.g. at school) can trigger conversations about the intervention's topic in other microsystems (e.g. the family). Additionally, intervention program participants communicate amongst themselves regarding interventions (Banerjee et al., 2015; Krieger et al., 2013; Southwell & Yzer, 2009), and these conversations are shown to influence intervention outcomes (Choi et al., 2017; Francis et al., 2021; Pinchoff et al., 2019). Network analyses of anti-smoking interventions have shown that intervention effects can transfer beyond the program participants to positively affect behaviors of friends who did not receive the intervention (Campbell et al., 2008; Rulison et al., 2015). As these conversations about intervention messages occur throughout a microsystem, it is important to consider that these messages are likely adapted by participants in both positive and negative ways (Pettigrew & Hecht, 2015).

The research reviewed herein demonstrates the importance of how intervention messages exist and transform within and across microsystems; however, to date there is minimal theoretical consideration of how microsystems interface in the time after intervention messages are delivered. SIM (Pettigrew et al., 2018) addresses this theoretical need by proposing four ways microsystems can interface at the mesosystem level: (1) transference, (2) negligible interface, (3) co-dependence, and (4) interdependence.

Transference

Some interventions are delivered with the expectation that the information they provide will be taken from the initial microsystem and enacted through behaviors in a different microsystem. The enactment of behaviors in a separate microsystem from which the intervention was delivered inevitably entails intervention messages being subjected to the factors inherent in the macrosystem and the microsystem into which the intervention messages are imported. For example, a school-based intervention may focus on deterring drug and alcohol use. Although the information is delivered in the school microsystem, the intervention targets behaviors that would likely occur in a non-school setting, such as parties or other social gatherings (Pettigrew et al., 2012). Thus, intervention messages communicated in one microsystem may lie dormant until need arises in a different microsystem.

Negligible interface

In some instances, interventions are delivered in the same microsystem in which the target behaviors are expected to be enacted. Although there is no such thing as an isolated microsystem, in the case of negligible interface, there is little to no influence on the intervention message from other microsystems, nor does the intervention have notable influence on behaviors occurring in microsystems beyond the site of the intervention. Accordingly, these instances represent the most limited cases of mesosystem interface. Factors that influence intervention messages are the social, individual, and message

factors occurring in the microsystem in which an intervention is delivered, as well as the structural affordances the macrosystem provides.

Co-dependence

A third way that two microsystems may interface at the mesosystem level is through co-dependence. In this case, the intervention is delivered in one microsystem but is dependent on inputs from one or more other microsystems for the intervention to be efficacious. For example, a school-based intervention may encourage its students to increase their daily intake of fruits and vegetables (Horne et al., 2009); however, for the intervention to be effective, the students' families must be motivated and able to purchase these foods for their children. Therefore, the success of the intervention is dependent upon the cooperation of a microsystem beyond the original site of the intervention.

Interdependence

Lastly, intervention messages might be delivered in two different microsystems, and indeed some research has demonstrated the effectiveness of a bi-directional, dual-site approach to delivering interventions (DeGarmo et al., 2009; Koning et al., 2011). Yet to be explored is the underlying mechanism that explains why interventions delivered across two microsystems are more efficacious. One possibility is an additive effect in which delivering an intervention in two microsystems entails an increased dose of the intervention as intervention components act independently in each microsystem in which they are delivered. A second possibility is that delivering interventions across multiple microsystems results in reinforcement and increased awareness of how intervention components can be enacted and applied across a variety of contexts or microsystems.

The current study

SIM proposes a complex view of how intervention messages are adapted when two microsystems interface with each other at the mesosystem level (see Figure 1 for the conceptual model). As previously mentioned, minimal research has empirically tested how intervention messages are socially interfaced at the mesosystem level. SIM proposes

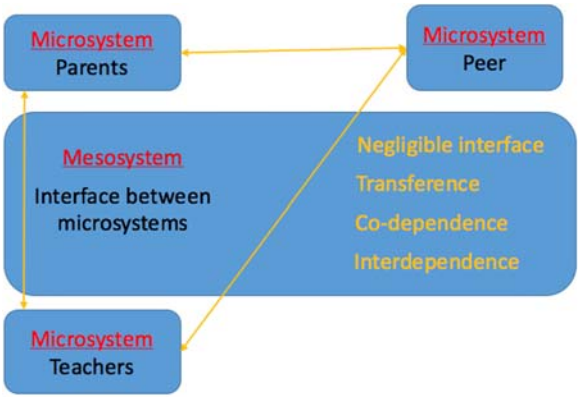

Figure 1. Proposed conceptual model of the social interface model.

four interfaces, but it is important to test this model against data to help clarify its limitations and benefits. A first step toward understanding the model's usefulness is to determine if and to what extent interfaces occur.

Guided by SIM, the present study examines *if* adolescents communicate about a school-based intervention with parents, peers, and teachers and *how* these conversations influence their views of the curriculum by identifying typologies of communication. The context for the study is the *Dale se REAL* (DsR) intervention delivered to 7th and 8th graders in Nicaragua, Central America. According to intercultural communication researchers Dutta and Martin (2017), Central America is a 'silent zone' for communication research. Thus, this study redresses a gap in knowledge through including a unique sample of adolescents.

This context is an appropriate site to examine mesosystem interfaces. As a school-based intervention, DsR theoretically relies on transference (i.e. the intervention message is delivered within one microsystem to create change in a separate microsystem). Behaviors like drug use and relational violence mostly take place in peer contexts; therefore, the goal of the intervention is to transfer the knowledge and skills taught in the classroom into the peer microsystem.

Examining communication that occurs across family members, peers, and teachers is also appropriate (Choi et al., 2017; Lu et al., 2020; Miller-Day et al., 2015; Shin et al., 2019; Shin et al., 2020). Primary socialization theory (Oetting & Donnermeyer, 1998), often used to understand health interventions (Petras & Sloboda, 2014), argues that adolescents' most salient microsystems are comprised of family, school, and peer systems. Moreover, previous research into parent–child communication about drug usage has demonstrated that an intervention like DsR can initiate conversations about drugs in microsystems beyond where the intervention was delivered (Krieger et al., 2013; Pettigrew et al., 2018; Shin et al., 2019). Thus, it is likely that DsR acts as a catalyst for the interfacing of two or more microsystems, at least for some adolescents, and that examining typologies of interfaces in this sample will provide a data-based exploration of the model. This study poses the following research question:

RQ: What profiles of communication patterns exist among adolescents participating in a school-based intervention?

Methods

Participants and procedure

Survey data were collected as part of a larger grant funded project to develop, deploy, and evaluate a substance use and violence prevention intervention in Nicaragua. The larger research project involved culturally re-grounding (Colby et al., 2013) two evidence-based programs – *keepin' it REAL* (Hecht et al., 2006) and the *Fourth R* (Wolfe et al., 2009) – for the Nicaraguan adolescent context. Both programs provide adolescents with skills that can prevent problem behaviors and align with the mission of producing public health benefits through global prevention efforts (Catalano et al., 2012). The *Dale se REAL* intervention provides 20 lessons on drug resistance strategies for 7th graders and 22 lessons on positive interpersonal relationships for 8th graders.

Private schools and youth serving organizations were recruited from three geographic regions in Nicaragua. These schools and youth service organizations represented a diversity of religious and socioeconomic status. In total, we recruited 18 schools and 5 youth service organizations that were Catholic and non-Catholic with monthly tuition in US dollars ranging from $1 to $535 ($M$ = $124; SD = $182). Teachers from the participating schools and organizations received the training to implement the DsR intervention and delivered the intervention to 7th and 8th graders. As a result, 1250 adolescents received the DsR intervention. For the survey data collection, we used a three-form planned missing data design (Graham et al., 1996), which enabled researchers to gather more data in less time than otherwise would be possible. Students participated in a Spanish version of a paper-pencil survey. All items originally developed in English were translated to Spanish by bilingual team members. Then they underwent a back translation procedure, which was verified by the Institutional Review Board. Because latent class analysis requires complete data and the survey data used the planned missing data design, the present study used only completed responses (N = 109) for statistical analyses.

Measures

This study used eight indicators that asked DsR intervention participants about their conversations regarding the intervention. Items assessing communication were prefaced with 'We want to learn with whom you talked about *Dale se REAL*. Please select the person or persons with whom you have spoken about the curriculum … . [and] indicate how each conversation(s) made you feel about the curriculum.' The first set of questions asked 'Have you spoken about the curriculum with … ' your mother/step mother, father/step father, best friend, and teachers who taught the curriculum (yes/no). The second set of questions asked 'Did this conversation make you feel that the curriculum was … ?' (1 = *less important*, 2 = *same level of importance*, 3 = *more important*). Table 1 shows the descriptive statistics of each variable.

Results

To answer the research question, a series of latent class analyses (LCAs) were run using Mplus (Muthén & Muthén, 1998). LCA was chosen because it was useful to discover

Table 1. Descriptive statistics of variables.

Indicator	Occurrence	*N* (%)	Evaluation	*N* (%)
Mother	Yes	62 (56.9%)	More Important	37 (33.9%)
	No	47 (43.1%)	Neutral	54 (49.5%)
			Less Important	18 (16.5%)
Father	Yes	44 (40.4%)	More Important	29 (26.6%)
	No	65 (59.6%)	Neutral	49 (45%)
			Less Important	31 (28.4)
Best Friend	Yes	70 (64.2%)	More Important	32 (29.4%)
	No	39 (35.8%)	Neutral	56 (51.4%)
			Less Important	21 (19.3%)
Teachers	Yes	60 (55%)	More Important	36 (33%)
	No	49 (45%)	Neutral	53 (48.6%)
			Less Important	20 (18.3%)

distinctive typologies of interfaces characterized by occurrence and valence of conversations with parents, peers, and teachers. To identify the optimal model, seven LCAs were performed (i.e. models with 1-class through 7-class solutions). These models were then compared according to several model fit criteria, including a smaller value for Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC), a higher value of entropy (i.e. closer to one), and interpretability of results (Collins & Lanza, 2010).

In comparing the seven models, we determined that the five-class model was more optimal than the one-, two-, three-, four-, six-, and seven-class models (*AIC* = 1205.52, *BIC* = 1418.14, Entropy = .949). That is, the five-class model identified the most distinctive characteristics of communication about the intervention based on the eight communication occurrence and importance indicators. Table 2 presents the fit criteria for each model.

To provide information about latent class membership, we used the maximum rule assignment (Nagin, 2005), which suggests that the highest conditional item response probability ultimately represents the class membership of each group. The conditional probability is the likelihood of representing specific characteristics in each latent class. Values closest to 1 suggest a higher probability of having the defining characteristics in a latent class. Table 3 presents latent class membership probabilities, class size, and conditional probabilities and Figure 2 shows where five latent classes are situated in three microsystems.

We labeled classes in terms of SIM and based on the assumption that when students reported that their conversations made them feel the program content was more important, it was positive (i.e. likely leading to less risky drug use or violence attitudes and behaviors). When participants evaluated the content as less important as a result of the conversation, we saw this as a negative adaptation of the program (i.e. likely leading to more risky attitudes and behaviors).

Class 1 (21.1%, $n = 23$) was characterized by adolescents reporting having conversations with their mother (100%), father (88%), best friend (91%), and teachers (83%). A majority of the conversations were seen to increase the importance of the curriculum with their mother (96%), father (89%), best friend (92%), and teachers (92%). The probability of latent membership for class 1 was 96.7%. We labeled class 1 based on terms from SIM as *optimal transference*.

Class 2 (17.4%, $n = 19$) was characterized by adolescents who reported having conversations with their mother (90%), father (95%), best friend (100%), and teachers (69%). Most of their conversations reportedly made little change to the importance of the curriculum with their mother (83%), father (69%), best friend (84%), and teachers (73%).

Table 2. Fit comparison of models with different numbers of latent classes.

Model	AIC	BIC	Entropy
1-Class	1545.57	1585.94	N/A
2-Class	1365.57	1449.00	.848
3-Class	1253.31	1379.80	.944
4-Class	1213.56	1383.12	.925
5-Class	**1205.523**	**1418.139**	**.949**
6-Class	1218.27	1473.90	.938
7-Class	1226.79	1525.53	.972

Note. The 5-Class solution was determined to be optimal.

Table 3. Five-class solution: Latent class probabilities, class size, and conditional probabilities.

Indicator	Total $N = 109$	Class 1 ($N = 23$, 21.1%)	Class 2 ($N = 19$, 17.4%)	Class 3 ($N = 19$, 17.4%)	Class 4 ($N = 31$, 28.4%)	Class 5 ($N = 17$, 15.7%)
Occurrence		Optimal Transference	Neutral Transference	Limited Positive Transference	Negligible Neutral Interface	Negligible Adverse Interface
Mother	Yes	100	90.3	65.1	17	29.4
	No	0	9.7	34.9	83	70.6
Father	Yes	88.2	95.2	6.1	4.1	17.6
	No	11.8	4.8	93.9	95.9	82.4
Best friend	Yes	91	100	5.2	37.7	0
	No	9	0	94.8	62.3	100
Teacher	Yes	82.8	68.5	79	31.7	17.6
	No	17.2	31.5	21	68.3	82.4
Evaluation						
Mother	More Important	95.7	17	51.6	4.4	0
	Neutral	4.3	83	27.7	95.6	17.6
	Less Important	0	0	20.7	0	82.4
Father	More Important	88.8	26.3	3.6	7.6	0
	Neutral	11.2	68.9	13.8	88.9	17.6
	Less Important	0	4.9	82.6	3.5	82.4
Best friend	More Important	91.6	6.4	32.9	9.8	0
	Neutral	8.4	83.6	51.6	90.2	0
	Less Important	0	10	15.5	0	100
Teachers	More Important	91.7	16.1	48.5	0	11.8
	Neutral	8.3	73.2	41	100	0
	Less Important	0	10.8	10.5	0	88.2

The probability of latent membership for class 2 was 97.8%. This class still exhibited SIM movement to a new microsystem, but this interface neither increased nor decreased the importance of the program, so we labeled class 2 as *neutral transference*.

Class 3 (17.4%, $n = 19$) was characterized by adolescents who had conversations primarily with their mothers (65%) and teachers (79%). These conversations led participants to feel the curriculum was more important with mothers (52%) and teachers (49%). Most of these adolescents, however, reported having no conversation with their father (94%) or with their best friend (95%). Of those who did engage in conversations

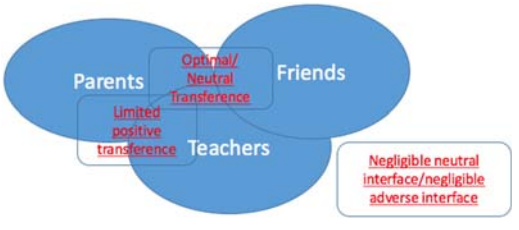

Figure 2. Five groups based on the LCA.

with their father or best friend, 83% and 52% respectively reported that the conversations led to feeling the program content was less important. The probability of latent membership for class 3 was 97.1%. We labeled class 3 as *limited positive transference*.

Class 4 (28.4%, $n = 31$) was characterized by adolescents who had no conversations with their mother (83%), father (96%), best friend (62%), and teachers (68%). Among those who did have conversations, most of the conversations reportedly did not change participants' view of the curriculum importance with mother (96%), father (89%), best friend (90%), and teachers (100%). The probability of latent membership for class 4 was 96.4%. We labeled class 4 as *negligible neutral interface*.

Class 5 (15.7%, $n = 17$) was characterized by a majority of adolescents reporting no conversation with their mother (71%), father (82%), best friend (100%), and teachers (82%). Those who engaged in conversations reported the curriculum was less important when conversing with their mother (82%), father (82%), best friend (100%), and teachers (88%). The probability of latent membership for class 5 was 100%. We labeled class 5 as *negligible adverse interface*.

Discussion

The present study examined interpersonal communication about a school-based intervention at the mesosystem level by examining communication across three separate microsystems (i.e. family, peer, school). Findings summarized these mesosystem interactions to identify five distinctive typologies of interpersonal communication based on adolescents' reports of eight communication occurrence and importance indicators. Guided by SIM, five latent classes were labeled as *optimal transference*, *neutral transference*, *limited positive transference*, *negligible neutral interface*, and *negligible adverse interface*. Adolescents in the *optimal transference* and *neutral transference* groups tended to have conversations across all three microsystems which were perceived to either increase the importance of the program or remain at the same level of importance.

Conversely, those in the *negligible neutral interface* and *negligible adverse interface* groups reported none or only a few conversations across microsystems. Conversations that did occur made no impact or made the curriculum feel less important. Interestingly, findings also showed that adolescents in the *limited positive transference* group had conversations within the family and school microsystems but not with their fathers or in the peer microsystem. Their conversations generally led to the perception that the curriculum was more or the same level of importance.

Understanding and theorizing post-delivery communication processes is an important frontier for health communication and intervention scholars. In many cases, the messages that are communicated within an intervention are intended to catalyze behavior change in other contexts (Pettigrew et al., 2018). If these post-delivery communication processes are ignored, interventions are left to rely on 'invisible logic models – a set of unspecified or unanticipated mechanisms for behavior change' (Pettigrew et al., 2018, p. 988). The descriptive typology offered in this study helps make these important processes visible, which in turn, allows for more effective intervention delivery that accounts for how intervention messages are viewed and changed beyond the intervention context.

Despite the fact that this study did not tie conversations to behavioral or attitudinal outcomes, it suggests that talk about school programs can be consequential. Over half the sample reported some kind of transference where participants had conversations about the school-based intervention. While intervention developers have assumed that messages carry from one context to another (and evidence of program effects tests for these transferences in terms of behaviors), this study directly assesses message movement. Classes 1 and 2 (39%) reported transferences across all three microsystems (school, at home, peers) and Class 3 (17%) indicated talk with peers and teachers. Our measures also examined how these conversations impacted participants' views of the program's importance. Encouragingly, many conversations increased the importance of the curriculum. Other conversations did not change participants' views of the program importance and a few made the curriculum seem less important. The results of this study have important implications for scholars and practitioners alike. Therefore, the remainder of our discussion focuses on the implications for the ongoing development of SIM and on the effects on post-delivery message processing.

Supporting and extending social interface model

SIM theorizes at least four potential mesosystem interfaces. Findings show evidence of at least two of these interfaces and also expand the complexity of how messages travel from one microsystem to another. It is often impractical for a single study to offer both a detailed overview of a model and a substantial analysis of data supporting the model (Roloff, 2015). Thus, the present study contributes to SIM development process by providing empirical support for two of its four theorized interfaces. Although SIM's other two theorized interfaces (interdependence and co-dependence) were not represented by our latent class analysis, this likely is due to the type of intervention tested in the current sample. School-based interventions usually depend on transference (Pettigrew et al., 2018), and findings confirm the presence of negligible interface and transference for the delivery of *Dale se REAL*.

In addition, a novel contribution to SIM from the current study is a more nuanced understanding of the ways transference and negligible interfaces may occur. Previously, SIM did not account for the various nuanced ways that transference may occur depending on the consequences of the interactions happening across microsystems. This study's findings suggest that transference is not a unidimensional experience and instead may occur in at least three different forms: *optimal*, *limited positive*, and *neutral transference*. It stands to reason, although not found in the current analysis, that some form of adverse transference may also occur. Although the majority (56%) of participants fit into some form of transference, not all instances of transference were homogenous. Likewise, 44% of participants were classified as experiencing negligible interface; however, similar to transference, not all instances of negligible interface were the same. Future theorizing may do well to account for the type of conversations that occur and their consequences.

Given that a school-based intervention's goal is to generate behavior change in peer, family, and school contexts through transference, the discovery of negligible interface for some participants may represent ineffectual or latent prevention. Data in this study cannot show whether adolescents forget, ignore, or use intervention skills in other

contexts. It is plausible to assume that some adolescents enact intervention skills without ever talking about the program. Learning and practicing a decision-making model, for example, does not necessarily require a discussion with a parent or friend. It is also possible that conversations never emerge due to lack of relevance. Some skills taught to early adolescents in prevention curricula (e.g. drug resistance strategies) may require increased exposure (e.g. drug offers) to become salient (Pettigrew & Hecht, 2015). When adolescents encounter more risky situations, they may then broach conversations about prevention programs they have taken. For others, negligible interface may indicate dismissing the material completely or even ridiculing it.

Taking a more nuanced understanding of transference and negligible interface aligns with prior research on 'social talk' surrounding intervention messages (Choi et al., 2017). Each possibility would have different effects on how intervention messages are recalled and (re)interpreted post-delivery.

Message half-life

Integrating how conversations impact the importance of programing messages into SIM may require new theorizing. We propose that intervention messages (perhaps marketing and other interpersonal messages, too) may have a half-life. A half-life is the speed at which nuclear matter decomposes. There is a natural half-life and also, under various conditions, nuclear material may decompose faster, slower, or may change form altogether (mutate). So too, intervention messages may have different rates of decay or adaptation under various circumstances.

In the context of adolescent substance use prevention, for instance, as positive conversations about the intervention that convey and validate the importance of the intervention messages take place, such conversations are highly likely to reinforce the desirable attitudes and behavior promoted by the intervention messages. This positive interface likely increases the half-life of the original prevention message. It prolongs or amplifies the effects of the intervention. Neutral conversations likely leave participants experiencing uninhibited, natural behavioral adoption processes described in SIM (a natural decay) whereas conversations that make curriculum material less important likely deter behavior change, shortening intervention message half-life. Some adverse interfaces may also mutate intervention messages, leading to negative adaptations or ridicule of prevention programs. The concept of half-life may be useful for further understanding SIM. It may also aid investigations of interpersonal communication about interventions.

Limitations

The present study makes a theoretical and practical contribution in prevention intervention research, yet several limitations should be noted. Despite the fact that the current study analyzed valuable data collected from adolescents in Central America, considered a hard-to-reach population in communication research, the sample size was relatively small ($N = 109$). We also used cross-sectional survey data using a planned missing data design. Although this design enabled us to collect a large sample that reflects a diverse group of Nicaraguan schools, geographies, and youth, findings are limited to the

Nicaraguan adolescent population. More efforts are needed to theoretically validate the ecological processes of SIM and empirically test and extend the model using different samples with a larger number of participants.

Additionally, the findings were based on the use of single item measures for communication occurrence with a dichotomous response option (yes/no) and an evaluation of how conversations made participants feel about the curriculum using only three response options items (1 = *less important*, 2 = *the same level of importance*, 3 = *more important*). Our communication occurrence measure did not include a 'not applicable' option, which may have created measurement error. For example, for adolescents who did not live with a father/stepfather, they may have skipped the item or potentially responded 'no.' This limits interpretation of the data, particularly for the 'no' response for conversation occurrence. In addition, future research might consider asking about frequency of communication (e.g. 1 = *never*, 5 = *all the time*). Finally, following others (Choi et al., 2017), another useful measure to understand SIM would be to capture the valence of conversations (1 = *very negative*, 5 = *very positive*) to offer insights on the effects of quality conversation on adolescent development outcomes.

The present study is also limited because it does not offer any insight into how family structure (e.g. divorced parents, birth order), typical communication patterns (do youth normally talk about school events/activities with family, peers, teachers), or psychological traits (e.g. introversion, extroversion) might play into the post-delivery processes. These dispositions and proclivities may all influence how adolescents communicate, including how they communicate about interventions.

Future directions

Although the results of this study support portions of SIM and contribute to our understanding of mesosystem interfaces, many questions still remain regarding post-delivery message processing and behavior change. For one, this study focused on the three primary microsystems adolescents encounter (i.e. family, peer, and school), and investigated communication similarities across these microsystems to examine general latent classes of post-delivery communication. An alternative, and potentially fruitful avenue would be to consider a broader array of communication within each microsystem. It is reasonable to expect that adolescents communicate within different microsystems in their lives to differing levels about various topics. Research on topic avoidance, for example, shows that mothers often hear the broadest array of topics from adolescents and young adults (Golish & Caughlin, 2002). For the limited positive transference class, this was especially evident.

Additionally, the results revealed the descriptive nature of the latent class membership. Although we successfully identified and described the characteristics of five latent classes, we propose that future researchers consider collecting longitudinal data. Such data would allow researchers to conduct a latent transition analysis (LTA) and regression analyses to explore how class membership changes over time and relates to intervention targets (e.g. proximal and distal outcomes). This is particularly important as the present study demonstrated that some participants did not engage in conversations about the intervention in other microsystems; however, it is possible that these conversations may occur at a later time, and once they do the person may transition into a different

class. Indeed, tracking changes in class membership over time may be an important predictor of the success of interventions.

Finally, researchers should test SIM with interventions that are structurally different from *Dale se REAL*. Conducting latent class analyses for interventions that inherently require interdependence or co-dependence across microsystems could result in a more nuanced understanding of those two interfaces, which were absent in the current study. The current study identified instances of transference and negligible interface for a school-based intervention and a latent class analysis illustrated that not all instances of interdependence or co-dependence are unidimensional. For example, interventions targeting healthy diet behaviors for children may rely on parents to provide healthy food options; and whereas some parents may gladly do so, others may do so begrudgingly, which may affect intervention outcomes for their children.

Conclusion

The present study offers a first empirical look at the mesosystem interfaces articulated in SIM. The findings provide a more nuanced description of two of the four mesosystem interfaces and also provide initial empirical support for SIM, using survey responses from Nicaraguan adolescents. The present study extends SIM by demonstrating that conversations can transfer to new contexts with consequences for perceptions of intervention material importance. The results also have practical implications for intervention practitioners – shedding new light on post-delivery communication processes impacting interventions and subsequent behavior change. This is one of a few studies that are not based on a sample of U.S. adolescents and provides an understanding of communication from one of the silent zones of research. The present study makes a unique contribution to the scholarship of communication by offering a diverse perspective in intervention research. Some may argue that our research findings may not be generalizable to the U.S. intervention research context, but we strongly believe that SIM is universal by nature and is applicable to disentangle the social processes of intervention research.

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