Examining Student Social Capital in a Comprehensive School-Based Health Intervention

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ABSTRACT

The purpose of this study was to explore 188 third through eighth-grade students' patterns of social interaction related to a comprehensive school-based health program, and to investigate relationships between student social capital (i.e., number and frequency of interactions with friends, teachers, and guardians/family members) and teacher implementation. Analyses of survey responses across three time periods revealed that students' patterns of social interaction differed significantly by grade level (elementary versus middle school) and time. There were also significant associations between student social capital and teacher implementation of intervention activities. These results suggest that educational leaders and policy makers attend to social interaction as a lever for intervention success.

INTRODUCTION

Numerous national and international organizations highlight the need for physical activity and knowledge for developing healthy lifestyles (e.g., National Association for Sport and Physical Education, 2008; World Health Organization, 2010). Yet, many elementary and secondary students lack the knowledge necessary for engaging in physical activity and healthy behaviors (Institute of Medicine, 2013; Nemet, Geva, & Eliakim, 2011). In addition, only a small proportion of American youth meet the national physical activity guidelines (Troiano et al., 2008). Comprehensive School Health Programs (CSHP) [also known as Whole-of-School and Whole School, Whole

Community, Whole Child models (e.g., www.ascd.org/programs/learning-and-health/wscc-model.aspx)] are one means for fighting negative trends in youth health and encouraging knowledge and behaviors that lead to healthy life trajectories. From a complex systems perspective, intervention success relies on interdependencies among stakeholders at multiple system levels (Byrne & Callaghan, 2014). Thus, understanding the patterns of interaction among organizational stakeholders may be critical to intervention success.

This study was part of a larger CSHP project aimed at changing the culture of a school to healthy and active, attending to the interdependencies among teachers, administrators, students, and guardians/family members. The purposes of the current study were to describe patterns of students' social interactions associated with CSHP activities (i.e., student social capital) and to investigate whether those interactions were related to program participation and success. Specifically, we examined third through eighth-grade students' patterns of social interaction (number of people talked to and the frequency of talk) related to healthy behaviors and their relationship to teacher implementation of intervention activities. We hypothesized that students' social capital would be associated with teacher implementation of intervention activities.

ECOLOGICAL COMPLEX SYSTEMS FRAMEWORK

When those attempting to implement interventions in school settings see schools and classrooms as mechanistic systems, then interventions are seen as adding new parts to improve functioning. Unexpected outcomes are thus interpreted as resulting from variation and error in implementation processes. From an ecological viewpoint, schools and classrooms are complex systems that resemble living organisms more than machines (Byrne & Callaghan, 2014). Interventions are then seen as tuning interactions among organizational participants to improve system functioning. Changes in networked connections among diverse individuals influence system-level outcomes, in this case, successful implementation of the CSHP intervention. Specifically, social interaction (i.e., social capital) within a school community may be a prime way that teachers and students exchange information and make sense of an intervention, thereby increasing participation and improving outcomes.

Conceptualizing schools as complex systems in which relational interdependencies are essential is congruent with a number of CSHPs developed around the world to help children and adolescents improve their health through increased physical activity, healthy eating habits, and healthy behavior knowledge (e.g., NASPE, 2008; Strong et al., 2005). Targeting change from multiple points has been frequently associated with positive health outcomes for students, (e.g., Harrell, Davy, Stewart, & King, 2005; Mahar et al., 2006). Conversely, programs that fail to utilize one or more components frequently have lower long-term success (Veugelers & Fitzgerald, 2005). For instance, authentically involving family members/guardians in encouraging students' healthy and active lifestyles may promote CSHP success (Sharma, 2007).

Lohrmann's (2010) ecological model of a coordinated school health program is harmonious with a complex systems perspective. Interpersonal factors, interpersonal processes, institutions, communities, and public policy are interdependent nested systems of contextual influence within which a CSHP is implemented. Change agents wishing to initiate and sustain such a program should attend to the interrelationships between these sub-systems when attempting to design strategies to foster student knowledge and behavioral changes. Sets of tactics should take into account biological and environmental factors that comprise health ecologies in order to capitalize on interdependencies among nested layers of influence (e.g., students, staff, families, community and cultural networks, institutions, and public policies).

The CSHP implemented in the current study took an ecological approach by including multiple intervention components: (a) increased Physical Education from one to two days per week, (b) trained teachers to implement classroom physical activity breaks, (c) implemented four school-wide wellness weeks during the year, (d) improved food service by adding more fruits and vegetables, and (e) integrated healthy behavior knowledge throughout the curriculum using Elementary Fitness for Life (Corbin, LeMasurier, Lambdin, & Greiner, 2010). Overall, analyses from the first year suggest that teachers increased their self-efficacy for promoting students' healthy behaviors and were able to implement aspects of the CSHP (Kulinna, Stylianou, & Lorenz, 2015). Additionally, students became more physically active and improved their healthy behavior content knowledge (Lorenz et al., 2015).

As students are the targeted population for change in any comprehensive ecologically based school change initiative, the current study focused on students' social interactions with school system stakeholders (i.e., their peers, teachers, family members/guardians) about topics and activities associated with the implementation of the CSHP program. Given the bi-directional influence of interactions in complex systems, we posited that teachers' intervention implementation would lead to increases in students' social interaction about activities and concepts related to the intervention (i.e., healthy behaviors). In a reciprocal fashion, students' interactions related to healthy behaviors might also influence teacher implementation of intervention activities. Guskey's (2002) model of teacher change provides support for this hypothesis.

According to Guskey, teachers' perception of positive changes in student outcomes are critically important for sustaining teacher change efforts as they attempt to implement new practices. As a teacher progresses from first encounters with a change initiative in training sessions to first attempts at implementing newly adopted curriculum, perceived positive student outcomes are needed to sustain change efforts. Thus, if students are talking to more stakeholders about healthy behaviors, this might spur more teacher implementation of intervention activities. Social capital is one framework that has proven useful in considering these types of interactional processes in complex systems (Moore, Salsberg, & Leroux, 2013).

SOCIAL CAPITAL AND SUCCESS OF EDUCATIONAL CHANGE EFFORTS

The concept of social capital has been used to describe the connections among networked actors, with whom and with what frequency individuals share information, as well as the strength and character of relationships. *Social capital* can be defined as the "network of associations, activities, or relations that bind people together as a community" (Farr, 2004, p. 9). For research purposes, social capital is operationalized in terms of both the quantity (i.e., number and frequency) and the quality (e.g., closeness, trust) of interactions among individuals within a system, the bonding networks that connect people and enable positive action. Frequency of interactions tends to co-occur with feelings of closeness to people with whom one is interacting (e.g., Reagans & McEvily, 2003). Thus, researchers commonly use either frequency or closeness alone or combine indicators of both as a marker of social capital (Pil & Leana, 2009).

Social capital in the form of social interaction among organizational members can perpetuate positive feedback loops that support system evolution (Nahapiet & Ghoshal, 1998). Numerous and frequent interpersonal interactions facilitate sharing of resources such as information, perspectives, and referrals (Coleman, 1988; Reagans & McEvily, 2003). Thus, the structural, cognitive, and relational connections among trusting members have positive value for actors pursuing shared goals (Adler & Kwon, 2002; Coleman, 1988). In other words, it matters to whom one talks and how frequently, what one talks about, and the quality of the relationship with one's interactants. Further,

social capital may require diversity in network members in order to avoid conformity of interpretations that constrain opportunities for positive outcomes (Burt, 2000).

Previous investigations of social capital in educational contexts have focused primarily on interaction among networks of teachers (e.g., Penuel, Riel, Krause, & Frank, 2009) and on identifying positive associations between teacher social capital and student academic outcomes. For instance, Leana and Pil (2006) found that K-12 students' sustained reading and math improvement was dependent on the extent to which a school culture was characterized by information sharing, trust, and shared vision among teachers. Informal social networks among teachers have also been associated with improved elementary math achievement (Pil & Leana, 2009) and can maximize teachers' access to knowledge and resources for changing professional practice (Baker-Doyle & Yoon, 2011). Our own previous study (Jordan, Lorenz, Stylianou, & Kulinna, under review) indicated that the frequency of a teacher's interactions with other teachers, administrators and/or students' family members increased the odds of a teacher implementing CSHP intervention activities.

Fewer studies have examined student social capital. However, existing research studies support the importance of student social interactions with multiple stakeholder groups for leveraging school-related success. For example, Goldsmith and Albrecht (1993) found that supportive communication among students improved exam performance. More specific to the current study, Wallhead, Garn and Vidoni (2013) identified peer bonds and peer approval as positive influences on adolescents' participation in, and enjoyment of, classroom physical activities.

Formation of supportive relationships with teachers can also support students' academic success (Stanton-Salazar & Dornbusch, 1995) and mental and physical health (Rickwood, 2013; Smith, Lounsbery, Crehan, & Weibel, 2006). The development of such relationships depends on students' network orientation, their willingness to seek out communication with school agents (Vaux, 1992). Students' willingness to initiate such communication, if honored, can help form supportive relationships that facilitate student success (Smith et al., 2006; Vaux, 1992). Finally, social capital is created through students' communication with family members. Such communication can positively impact not only individual students but also their community (Auerbach, 2007; Coleman, 1987), a reciprocity we would expect to find in complex systems.

RESEARCH QUESTIONS

Hypothesizing that a student's social capital (i.e., number and frequency of social ties with peers, teachers, and guardians/family members) would be positively related to the implementation of a CSHP intervention, we addressed four research questions. The first two questions sought to characterize students' social capital related to the intervention.

RQ1: What are the patterns of students' social interactions about healthy behaviors related to the CSHP and how do they change across time?

RQ2: Do patterns of interaction differ between elementary and middle school students?

The last two questions investigated the reciprocal relationship between teacher implementation and student social capital.

RQ3: Is teacher implementation of CSHP activities related to student social capital?

RQ4: Does student social capital influence teacher implementation of CSHP activities?

METHOD

PARTICIPANTS AND SETTING

The setting for this study was a K-8 rural school district with approximately 400 students. The district had low student attendance and was rated by the state as underperforming. In this district, teacher turnover was high; student retention was low. The school district agreed to take on healthy behavior initiatives and to adopt a CSHP as a means of improving the poor health trends reported for the broader community.

For the purpose of this study, an important element of the intervention involved classroom teachers' implementation of wellness week activities (Corbin et al., 2010). Three wellness weeks and subsequent data collection occurred approximately every nine weeks across the school year. Wellness week included teacher-implemented components. These classroom-level activities included physical activity breaks (e.g., marching around the room while skip counting) and seven knowledge/conceptual activities related to healthy behaviors: conceptual messages from program DVDs, posted signs on healthy behaviors, wellness chants, "Eat Well Wednesday" and/or "Get Fit Friday" activities, newsletters to help guardians/families get involved, and nutrition and fitness worksheets. Classroom teachers in grades K-8 received grade level textbooks and training to integrate healthy behavior knowledge and activities across curriculum content. There was also a website with resources available for teachers and a mentor who communicated with teachers monthly and visited them twice during the intervention.

Data were drawn from teachers and students in third through eighth grade regular education classrooms. Participants included 188 students (female=88; 103 in grades 3-5, 85 in grades 6-8) and their nine homeroom teachers (all self-reported as Caucasian; teaching experience M=16.60 years, SD=.25 years). Fifty-nine percent of students reported their ethnicity as White, 30% as Hispanic, 4% as Native American, and 7% as Other. Thirty-seven percent of girls were overweight or obese along with 33.6% of boys (based on Center for Disease Control's BMI-for-age growth charts for boys and girls).

DATA COLLECTION AND PROCEDURES

This study followed teachers' implementation of intervention activities and students' reported social interactions about healthy behaviors through instruments administered confidentially immediately following the three wellness weeks. Following each of the three wellness weeks, students were asked to complete the Student Social Capital instrument modified from Pil and Leana (2009). It contained 13 items about student-respondents' communication about healthy behaviors. Students were asked to report the number of friends, teacher and family members/guardians they had interacted with across the wellness week as well as the frequency of those interactions as two indicators of social capital. Although Pil and Leana (2009) included in their instrument items on closeness and trust, these were removed from the current instruments because school personnel were not comfortable with students responding to these items. Students were also asked to report the number of times in the past week they requested a physical activity break from their classroom teacher. We thought of such requests as an additional aspect of social capital illustrating students' network orientation (Vaux, 1992). Surveys were administered by students' homeroom teachers and collected by the school's wellness coordinator. At the same time points, teachers were asked to self-report the number of times they implemented each type of wellness week activity. Fidelity of reporting was supported through observations as well as interview data (Jordan et al., under review).

Table 1
Descriptive statistics of Student Social Capital and Teacher Intervention Participation

Variables	N	*M*	SD	Min	Max	Missing Values	
						Count	Percent
Number of Friends T1[a]	149	1.98	3.23	0	20	39	20.7%
Number of Friends T2	170	1.38	2.64	0	20	18	9.6%
Number of Friends T3	166	1.08	1.99	0	15	22	11.7%
Frequency of Friends T1[b]	151	1.00	1.82	0	10	37	19.7%
Frequency of Friends T2	170	1.28	2.70	0	20	18	9.6%
Frequency of Friends T3	166	1.07	2.04	0	12	22	11.7%
Number at Home T1	151	1.47	2.50	0	16	37	19.7%
Number at Home T2	170	1.31	1.63	0	8	18	9.6%
Number at Home T3	166	1.18	1.65	0	7	22	11.7%
Frequency at Home T1	151	1.67	2.56	0	12	37	19.7%
Frequency at Home T2	170	1.70	2.61	0	16	18	9.6%
Frequency at Home T3	166	1.31	2.45	0	20	22	11.7%
Number of Teachers T1	149	1.66	1.75	0	10	39	20.7%
Number of Teachers T2	166	1.14	1.24	0	6	22	11.7%
Number of Teachers T3	163	1.10	1.17	0	6	25	13.3%
Frequency of Teachers T1	149	2.37	3.61	0	18	39	20.7%
Frequency of Teachers T2	166	1.37	2.30	0	20	22	11.7%
Frequency of Teachers T3	163	1.51	2.06	0	12	25	13.3%
Asked for PA Breaks T1	147	1.55	2.79	0	15	41	21.8%
Asked for PA Breaks T2	162	1.15	2.20	0	20	26	13.8%
Asked for PA Breaks T3	160	1.13	2.70	0	20	28	14.9%
Teacher Participation T1[c]	188[d]	12.03	11.83	0	33	0	0.0%
Teacher Participation T2	133	4.37	3.91	0	12	55	29.3%
Teacher Participation T3	152	7.21	4.68	1	15	36	19.2%

Note. Means and standard deviations are maximum likelihood estimates that account for missing data for descriptive statistics of student social capital and teacher participation.

[a] "Number" refers to the average total number of people a student reported speaking to about physical activity breaks or Wellness Week activities across all student observations ($n = 188$).

[b] "Frequency" refers to how often a student reported they spoke to someone about physical activity breaks or Wellness Week activities across all student observations ($n = 188$).

[c] Teacher participation refers to the average total number of classroom physical activity breaks and/or Wellness Week activities across all teachers ($n = 9$).

[d] Please note that student observations are nested within teachers, so the above data report student-level data; therefore, every student within the same class was recorded as having the same teacher participation value.

DATA ANALYSIS

Descriptive statistics were computed and data were analyzed using the general linear model procedure and the generalized linear mixed model procedure in SAS 9.3 for Windows (Cary, NC) for student social capital variables and teacher participation in wellness week activities. A combined variable was created by adding teacher participation in all wellness week activities at each time period. Variables were also created to represent the number and frequency of student talk across friends, teachers, and family members/guardians about healthy behaviors for each time period. Specifically, we used a doubly multivariate repeated measures mixed model analysis of variance to determine patterns of student interaction and changes over time (RQ1), including differences between grade levels (RQ2), and to describe relationships between teacher implementation and student social capital (RQ3).

We used a generalized linear mixed model to determine whether student social interactions with diverse stakeholders and student requests for classroom physical activity breaks influenced teacher implementation of wellness week activities (RQ4).

Table 2

Mean differences between Elementary and Middle School Students' Social Capital Variables

Variable	Mean Difference	95% Confidence Limits	
		Lower	Upper
Number of Friends T1	1.17	-0.11	2.44
Number of Friends T2	1.15*	0.50	1.79
Number of Friends T3	0.93*	0.32	1.53
Frequency of Friends T1	-0.41	-0.17	1.00
Frequency of Friends T2	1.01*	0.26	1.76
Frequency of Friends T3	0.85*	0.02	1.67
Number at Home T1	0.79	-0.20	1.77
Number at Home T2	1.03*	0.38	1.67
Number at Home T3	0.99*	0.39	1.58
Frequency at Home T1	0.53	-0.51	1.56
Frequency at Home T2	0.94	-0.07	1.95
Frequency at Home T3	0.92*	0.13	1.70
Number of Teachers T1	1.65*	1.10	2.21
Number of Teachers T2	1.30*	0.86	1.75
Number of Teachers T3	0.97*	0.57	1.37
Frequency of Teachers T1	3.09*	1.95	4.23
Frequency of Teachers T2	1.62*	0.60	2.65
Frequency of Teachers T3	1.72*	0.88	2.55
Asked for PA Breaks T1	1.55*	0.60	2.50
Asked for PA Breaks T2	0.20	-0.69	1.08
Asked for PA Breaks T3	0.08	-0.60	0.75

Note. *Indicates significant mean difference between grades levels, using Tukey's HSD for multiple comparisons to control Type I error rate. Positive values indicate that elementary students had greater number or frequency of talk; negative values indicate that middle school students had greater number or frequency.

The student social capital data were the dependent variables for research questions one through three, and teacher participation was modeled as the dependent variable for research question four. The independent variables for questions one through three were teacher, grade level and time; and student social interactions with diverse stakeholders and requests for physical activity breaks were the independent variables for research question four. These analyses were conducted in order to test the reciprocal relationships between teacher implementation and student social capital. Missing data ranged from 0 to 30% for student and teacher variables. The general linear model procedure in SAS does not process missing data for independent variables, therefore, all mean and variance estimates use only complete records.

RESULTS

Research Question 1 addressed changes across time in patterns of students' social interactions about healthy behaviors related to the CSHP. Table 1 displays the average number and frequency a student spoke to individuals from one of the stakeholder groups about healthy behaviors, along with the average participation of classroom teachers in wellness week activities across the three time points. Results from the doubly multivariate repeated measures analysis of variance showed that the average number and frequency of student talk were different across students (Wilks'Λ=0.1791, $F(7, 207) = 70.07$, $p < 0.0001$). In addition, the dependent variables of number and frequency of student talk were significantly different across time (Wilks'Λ=0.5679, $F(14, 100) = 5.43$, $p < 0.0001$). In general, the typical amount of student talk with the various stakeholders was different for every student, and these patterns did change with

Table 3
Means and Standard Deviations of Student Social Capital Variable Split by Teacher

	Teacher 1		Teacher 2		Teacher 3		Teacher 4		Teacher 5		Teacher 6		Teacher 7		Teacher 8		Teacher 9	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Number of Friends T1	1.28	3.27	3.47	4.18	1.44	2.06	2.42	3.06	.	.	.	.	2.17	2.86	1.30	0.77	1.28	2.64
Number of Friends T2	0.77	1.14	1.61	1.99	1.75	2.05	2.61	2.15	.	.	.	.	0.42	0.67	1.13	1.92	1.00	4.01
Number of Friends T3	0.34	0.72	1.19	1.45	2.24	2.68	2.16	1.71	0.57	0.98	1.94	4.99	0.21	0.58	2.18	4.53	0.25	1.12
Frequency of Friends T1	0.28	0.73	0.00	0.00	1.63	2.85	1.89	2.23	0.67	1.00	0.56	0.81	2.25	2.83	0.73	1.16	0.76	1.54
Frequency of Friends T2	0.97	1.56	1.48	2.05	1.81	2.99	2.72	4.56	.	.	.	.	0.50	0.80	0.87	1.55	0.36	0.99
Frequency of Friends T3	0.66	1.99	1.45	2.36	1.71	2.52	2.05	1.93	0.29	0.49	1.88	4.99	0.21	0.43	1.27	2.15	0.25	1.12
Number at Home T1	1.41	1.43	1.91	2.44	1.81	3.71	2.00	3.54	0.67	0.87	0.56	1.03	1.42	1.78	1.82	0.84	0.84	2.10
Number at Home T2	1.03	1.40	1.70	1.81	2.04	2.28	2.28	1.81	.	.	.	.	0.83	1.03	1.68	0.36	0.36	0.81
Number at Home T3	0.79	1.35	1.81	1.85	1.35	1.73	2.42	1.92	0.43	0.79	1.31	1.82	0.71	1.14	1.34	0.30	0.30	0.92
Frequency at Home T1	1.66	2.29	3.10	2.03	2.06	2.67	2.11	1.85	.	.	.	.	1.83	2.69	1.33	0.84	0.84	2.17
Frequency at Home T2	1.67	2.67	1.87	1.98	2.75	3.97	2.06	2.04	1.29	2.98	2.44	4.10	1.25	1.66	1.67	2.64	0.40	0.96
Frequency at Home T3	1.07	1.65	1.71	1.71	1.35	1.73	1.92	2.05	1.00	1.41	0.75	1.18	0.64	1.01	1.00	1.34	0.30	0.92
Number of Teachers T1	2.47	1.05	1.88	0.83	2.13	2.50	3.95	0.85	.	.	.	.	1.25	1.86	1.25	1.83	1.83	2.17
Number of Teachers T2	1.33	0.61	1.65	1.56	1.56	1.46	2.18	1.19	0.43	0.53	0.86	0.95	0.67	0.49	0.07	0.40	0.67	1.33
Number of Teachers T3	1.07	0.46	1.23	0.90	1.94	1.82	2.22	1.26	0.56	0.73	0.80	1.52	0.57	0.65	0.82	0.60	0.60	1.25
Frequency of Teachers T1	3.19	1.55	2.28	2.71	2.75	2.89	8.32	6.05	.	.	.	.	2.09	1.25	0.14	0.58	0.26	0.58
Frequency of Teachers T2	1.83	1.74	1.74	1.90	4.86	4.86	1.26	1.95	0.53	0.79	0.79	0.97	0.83	0.57	0.60	0.60	0.65	0.68
Frequency of Teachers T3	2.41	1.99	2.17	2.80	1.76	1.79	2.56	2.20	0.44	0.53	0.53	0.80	0.79	1.09	0.36	0.68	2.30	1.19
Asked for PA Breaks T1	1.63	2.24	2.25	3.01	0.54	0.72	5.21	3.05	.	.	.	.	2.17	2.25	0.77	0.26	1.25	0.54
Asked for PA Breaks T2	0.23	0.43	1.58	3.76	0.38	0.72	2.76	1.64	1.67	1.97	2.08	2.36	2.27	2.28	0.07	0.50	0.79	1.53
Asked for PA Breaks T3	0.00	0.00	0.66	1.23	0.65	1.00	4.00	3.34	1.11	2.42	2.64	5.76	1.36	1.82	1.36	1.96	0.21	0.54

Note. Means and standard deviations are arithmetic means and are not adjusted for missing data or other variables. The frequency of responses was different for each teacher for each variable. Teacher 1, *n* = 29 to 32; Teacher 2, *n* = 29 to 32; Teacher 3, *n* = 16 to 17; Teacher 4, *n* = 17 to 19; Teacher 5, *n* = 0 to 9; Teacher 6, *n* = 0 to 16; Teacher 7, *n* = 12 to 14; Teacher 8, *n* = 11 to 15; Teacher 9, *n* = 9 to 15. Table cells with a period (.) represent missing data.

time. On average, student social interactions about healthy behaviors were highest in both number and frequency at Time 1 (T1) for all categories of stakeholders. Student requests for physical activity breaks were also highest in T1.

Research question 2 examined differences in student social capital between grade levels, and an analysis of variance yielded a main effect for grade level (elementary versus middle school; $F(1, 113) = 26.75$, $p < 0.0001$). Generally, elementary students had greater number and frequency of talk than middle school students, with friends and teachers being more commonly engaged by elementary students than guardians/family members. Table 2 represents mean differences between elementary and middle school students and the number and frequency of student talk across all three time points.

Research question 3 examined the relationship between teacher implementation and student social capital via the mixed model portion of the analysis, with a random effect for teachers that were sampled from a distribution of teachers from the school, and to account for the clustering of students within teachers. On average, there was a between-subjects effect for teachers ($F(5, 113) = 5,20$, $p = 0.0002$) meaning that different teachers had different influences on the number and frequency of student interactions within their classes. Furthermore, this effect was different for the different forms of social capital at different times, meaning that a proportion of the variance in students' social capital can be explained by their teacher.

When teachers did more wellness week activities, students tended to talk to more friends about healthy behaviors (at T2 and T3) and to talk to them more frequently (at T1). They also tended to talk to more teachers (at T1 and T3) and to talk to them more frequently (at T1). However, teacher implementation was not related to the number or frequency of students talking with guardians/family members. Table 3 outlines the differential effects of teacher on the various student social capital variables and Table 4 represents the average number and frequency of student talk across the nine teachers.

Table 4

Random Effects of Teacher on Student Social Capital Variables

Student Social Capital Variable	F-statistic[a]	p-value[b]	η^2
Number of Friends T1	1.37	0.2398	0.0573
Number of Friends T2	2.80*	0.0202	0.1102
Number of Friends T3	4.80*	0.005	0.1752
Frequency of Friends T1	5.19*	0.003	0.1868
Frequency of Friends T2	0.72	0.6116	0.0308
Frequency of Friends T3	1.35	0.2481	0.0564
Number at Home T1	0.18	0.9703	0.0078
Number at Home T2	1.78	0.1228	0.073
Number at Home T3	1.98	0.0863	0.0807
Frequency at Home T1	0.25	0.9395	0.0109
Frequency at Home T2	0.54	0.7411	0.0234
Frequency at Home T3	1.43	0.2183	0.0596
Number of Teachers T1	4.84*	0.0005	0.1765
Number of Teachers T2	1.27	0.2834	0.0531
Number of Teachers T3	4.82*	0.0005	0.1758
Frequency of Teachers T1	12.21*	0.0001	0.3508
Frequency of Teachers T2	0.31	0.904	0.0137
Frequency of Teachers T3	0.19	0.9668	0.0082
Asked for PA Breaks T1	7.5*	0.0001	0.2492
Asked for PA Breaks T2	4.41*	0.0011	0.1632
Asked for PA Breaks T3	13.32*	0.0001	0.3709

Note. [a] Degrees of freedom for all F-tests are (5, 113), with $F_{critical} = 2.2946$.
[b] Alpha = 0.05.
η^2 refers to proportion of variance of the student social capital variable explained by the teacher.

Table 5

Estimates of the Influence of Student Social Capital on the Number of Teacher Participation

Effect	Estimate[a]	Standard Error	DF	t-value	*p*-value
Number of Friends	0.660*	0.153	207	4.31	<0.0001
Frequency of Friends	-0.902*	0.206	207	-4.38	<0.0001
Number at Home	0.071	0.240	207	0.30	0.7659
Frequency at Home	0.072	0.188	207	0.38	0.7038
Number of Teachers	0.331	0.328	207	1.01	0.3139
Frequency of Teachers	0.123	0.155	207	0.80	0.4274
Number of PA Break Requests	0.558*	0.139	207	4.01	<0.0001

Note. [a] Estimate of the slope parameter where a one-unit increase in the effect results in the corresponding change in the expected number of teacher participation.

Due to missing data, Teachers 5 and 6 were excluded from the linear model analysis, thus the discrepancy in the degrees of freedom from the tests in Table 4.

Research question 4 examined whether student social capital and the number of requests for physical activity breaks influenced the total number of wellness week activities that teachers reported implementing. Using a generalized linear mixed model, we estimated a significant random intercept ($z = 7.1075$, $p < 0.0001$) for the model, meaning that students have different starting points and variance components within the model. Results from the generalized linear mixed model identified the number of friends ($F(1, 207) = 18.59$, $p < 0.0001$), the frequency of talking to friends ($F(1, 207) = 19.18$, $p < 0.0001$), and the number of times students requested physical activity breaks ($F(1, 207) = 16.11$, $p < 0.0001$) were significant predictors of the number of reported teacher participation in wellness week activities. The number and frequency of students speaking to people at home and the number and frequency of speaking to teachers had no significant influence on teacher participation. Individual estimates of the magnitude and direction of the influence on the number of wellness week activities can be found in Table 5.

DISCUSSION

The purpose of this study was to characterize students' patterns of social interaction related to a CSHP intervention and to investigate the relationship between teacher implementation of intervention activities and students' patterns of social interaction, what we characterized as social capital. Results indicate that student social capital was related to teacher participation in the CSHP intervention, supporting the theory that informal social interaction is a lever for facilitating change interventions in complex systems (Jordan, 2009) such as schools and classrooms. From a complex systems perspective, teacher implementation of intervention activities is likely to increase student social capital, while reciprocally, student social capital is likely to lead to enhanced teacher implementation.

Overall, students' social interaction with all significant stakeholders about healthy behaviors was highest in number of interactants and frequency of interactions at T1 (RQ1). The more intense nature of ties at T1 may be due to initial excitement for the Fitness for Life program, since the program was very recently introduced at that point. Additionally, many students' social capital did not extend to interactions with any individuals in one or more stakeholder groups. Because social interaction provides resources for taking positive action (e.g., engaging in healthy behaviors), it is potentially troubling that some students were not talking with anyone in the ecological system of their school (including guardians/family members), even during weeks that such

behaviors were being highlighted in their school and emphasized in their classrooms. Lack of social interaction may inhibit opportunities for sense-making and positive feedback that, in turn, may likely promote student participation in intervention activities and uptake of healthy behaviors promoted by the school-wide intervention.

Patterns of social interaction differed between elementary (3-5) and middle school (6-8) students (RQ2). Specifically, elementary students tended to talk with a greater number of people in all stakeholder groups and with higher frequency than middle school students. These results could indicate that elementary students are more willing to engage in conversation about healthy behaviors in general than are middle school students. Perhaps physical, emotional, and social changes associated with adolescence make discussing these topics awkward for middle school students. These differences were particularly strong for frequency of talking to teachers across all three time periods. Again, this may be related to maturational issues. Alternatively, these dynamics may be related to the types of activities that teachers at each level implemented for wellness weeks.

Findings identified significant relationships between a teacher's participation and the number and frequency of students talking with friends and/or teachers about healthy behaviors (RQ3). Given the models ran, this was interpreted to mean that teacher implementation of CSHP activities influences student social capital. The lack of association between teacher implementation and students talking with family members/ guardians is potentially reason for concern. Previous studies suggest that CSHP success may depend on widening the scope of school-wide interventions to include guardians/ family and community members in supporting schools' promotion of students' healthy behaviors (Sharma, 2007). Perhaps explicit teacher encouragement of student talk is needed for students to move the conversation beyond the school walls.

Interpreting the social dynamics of students in the school system that was the site of this study must also consider the reciprocal influence of interactions in complex systems. Therefore, an additional model was run to examine the influence of student social capital on teacher implementation (RQ4). Students' self-reported requests for classroom physical activity breaks were positively associated with their teacher's implementation of wellness week activities. This result is supported by results from our previous study, which identified a significant positive correlation between teacher reports of the number of times students requested a physical activity break and the number of physical activity breaks a teacher reported implementing (Jordan et al., under review). Furthermore, our analysis identified an influence on teacher participation through the number and frequency of students talking with friends about healthy behaviors. However, the influence was positive for number of friends talked to and negative for frequency of talking with friends. Possibly, frequent student-to-student interactions had unintended consequences on the teachers (for example, students talk to each other more about physical activity breaks and the teacher perceives they do not like them so they do them less, or the teacher perceives that student-to-student talk disrupts further instruction). Because frequency and number of friends produce opposite signs, more investigation is needed into what is being said and how that might influence teacher implementation.

Given the prominence of feedback about student reinforcement in Guskey's (2002) model of teacher change, student interactions with their teacher might positively impact whether that teacher implemented intervention activities. This was likely the case if teachers perceived that student talk was a positive outcome of teacher implementation. Then again, teacher implementation might have prompted student requests, or teacher and student actions may have been mutually reinforcing, perpetuating a positive feedback loop common to complex systems as reciprocal relationships lead to co-evolution of system dynamics (Nahapiet & Ghoshal, 1998).

IMPLICATIONS

These results suggest a need for educational leaders and policy makers to attend to the influence of social interaction in school-wide change efforts and to consider ways to support such interaction to encourage implementation. However, more research is needed to understand the underlying dynamics by which social capital potentially affects school-related outcomes. The design of the present study does not allow us to ascertain why student social capital was positively associated with teacher implementation of intervention activities. This initial study was conducted in one rural school district with unique challenges. As such, its findings may be highly contextual. Studies in other school environments are needed to corroborate these results. Longitudinal studies that follow social interactions over extended periods of time might also yield further insights into these dynamics. As Guskey (2002) contended, changing practice is a gradual and difficult undertaking for teachers. The same is true for students, and this may well be reflected in student social interactions related to intervention activities. Finally, this study was limited in measuring only structural and cognitive aspects of student social capital. Further studies should attempt to measure more relational aspects of student social capital (e.g., closeness, trust), as these are also important in creating social resources.

Due to limitations in data collection, this study was not able to investigate a relationship between student social capital and student healthy behavior outcomes. However, relating the findings from the current study to our previous findings that teacher social capital had positive effects on their implementation of CSHP activities (Jordan et al., under review), it seems likely that students' social capital could have positive effects on student uptake of CSHP activities as well. Social capital may do its work through exposure to diverse ways of interpreting curricular innovations such as the school-wide health initiative implemented in this study. Students can incorporate new perspectives into their own approaches to being healthy and active through exposure to their friends', teachers', and/or family members' viewpoints. Talking with others may also increase a student's comfort-level with unfamiliar curricular material so that they are more willing to risk participating in healthy behaviors. Or possibly, frequent interaction about newly introduced ideas simply keeps the ideas on a student's mind, reminding him or her to engage in healthy behaviors. Finally, social capital may have an effect by promoting students' self-determined motivation toward CSHP goals through supporting their perceptions of their own autonomy, competence, and relatedness associated with the intervention (Leake, 2015).

In summary, theoretical models of schools as complex systems and ecological models of CSHPs suggest that social interaction among diverse stakeholders may be related to long-term intervention success. By demonstrating a relationship between students' social interaction and teachers' implementation of activities, this study indicates that student social capital, teacher implementation, and CSHP goals may be mutually, reciprocally influencing. Student social capital in the form of interaction with friends, teachers, and family members/guardians about topics and activities related to a CSHP might facilitate teacher uptake of intervention activities. In a reciprocal fashion, teacher implementation may increase students' social capital, creating resources that support long-term cognitive and behavioral change. Increasing students' awareness of their social interactional networks may foster their ability to utilize their social capital to promote behavioral change, as has been found for teachers (see Baker-Doyle & Yoon, 2011). School leaders might also consider strategies that could be employed to increase student interactions with family members/guardians (i.e., newsletters, integrating family academic events with program activities; see Maes, 2012). ■

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