Development and validation of the survey of knowledge of internet risk and internet behavior

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Development and Validation of the *Survey of Knowledge of Internet Risk and Internet Behavior*

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Abstract

The development of the *Survey of Knowledge of Internet Risk and Internet Behavior* is described. A total of *N*=1366 grade 7-8 male and female students from an urban, suburban, and rural school offered Agree-Disagree responses to 26 statements defining one knowledge scale and five behavior dimensions. Literature-based support is presented for content validity. Construct validity support for the hypothesized dimensions is provided through Rasch model analysis of the Knowledge scale supporting a unidimensional, hierarchically ordered scale. Latent class analyses provided support for the utility of the five categorical behavioral dimensions. Implications for instrument developers and educators are discussed.

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Middle school students "face many new obstacles that the administration and parents did not experience. The student has not changed, per say; however, the world around that student has changed drastically in regards to technology access, globalization, and adolescent behaviors" (Jackson, 2009). Technology and the Internet are staples in our children's lives for both entertainment and academic purposes. In fact, in 1994, only 35% of schools had access to computers with Internet access, while by 2005 virtually every school had Internet access (99%) (Parsad & Jones, 2005).

An estimated 93% of teens (age 12-18) are on-line (Lenhart, Purcell, Smith, & Zickuhr, 2009). Students utilize cell phones, personal digital assistants, home computers, and laptop computers to access the Internet and communicate with friends almost instantly. This increased dependence on technology, especially the Internet, intensifies the importance of appropriate behaviors while using on-line tools. The consequences of inappropriate behavior can be life threatening. The threat of Internet predators and cyberbullies increases as time on-line with no boundaries increases. In fact, Hinduji and Patchin (2010) found that "victims of cyberbullying in middle school were much more likely of scoring high on a suicide ideation scale than students who were not victims".

Supporting safe environments for students at school/home is an important concern for educators and parents (Feinberg & Robey, 2007) Goodstein (2007) reported that a survey by Cox Communications and the Center for Missing and Exploited Children indicated that 14% of teenagers have face-to-face meetings with people they have met

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online. Goodstein also reported that 16% of N = 2010 teens under age18 indicated they had virtual sex or cybersex (i.e., chat or webcam) with someone they met online (p. 71-72). In 2005 Lenhart stated that 62% of parents reported monitoring the activity online after their child had gone on line. Conversely, however, only 33% of the teens believe that their parents actually monitor their activity. Accordingly, it is likely that the knowledge of being monitored may prevent inappropriate and unsafe behaviors.

In order for schools and parents to create educational programs for safe Internet use, a clearer understanding of the specific issues regarding knowledge of on-line risks and Internet behaviors is needed (Erb, 2006). The key to these efforts is assessment of what students know about the risks of bullying and predators and what behaviors they are currently victims of or tend to engage in themselves. This article describes the development and validation of an instrument that assesses middle school students' knowledge of appropriate use of the Internet and social networking sites regarding behaviors that lead to cyberbullying or contact with potential Internet predators. Students' reported experiences with inappropriate Internet behaviors are assessed.

The intended uses of the instrument are to assess the level of student knowledge regarding the appropriate uses of the Internet and social networking sites, the extent that the described behaviors are occurring in a school, and to assist in identifying the extent that groups of students or individuals are at risk of falling prey to Internet predators.

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Methodology

Sample

A total of *N*=1366 grade 7-8 male (*n*=698) and female (*n*=666) students from an urban (*n*=480), a suburban (*n*=418), and a rural (*n*=468) school responded to the survey entitled *Survey of Knowledge of Internet Risk and Internet Behavior* during a regularly scheduled school activity period. Although these students constitute a sample of convenience, they consisted of all the students in grades 7-8 at each school; their data are appropriate for the first large scale field test of the instrument.

Instrumentation

Scales and scoring technique. The *Survey of Internet Risk and Internet Behavior* contained 7 literature derived demographic items: gender, grade level, have older siblings, earn good grades, are you popular, ever get into trouble at school, and own a cell phone (Franek, 2005/2006; Lenhart, 2005; Ma, 2001; McKenna, 2007; Shariff, 2008) and 26 statements constructed to describe students' knowledge of risks and behaviors associated with using the Internet (Gable, Ludlow, Kite, McCoach, & Filippelli, 2009).

Response format. Students were asked to "Agree" or "Disagree" with each statement. Responses were scored "1" or "0" to reflect a high level of the attribute measured by the scale. Appropriate agreeing or disagreeing with a statement received a score of "1" (e.g., agree with the statement: *Making threats online can get me into trouble with the police.*); an inappropriate agree or disagree response was scored "0". This scoring technique was designed to produce scores where high scoring students had higher levels of knowledge, were more often bullied, tended not to participate in

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bullying, had parents who were aware of their child's Internet activities, used the Internet more often, and were willing to contact an adult if they were threatened by a peer or stranger on the Internet.

The Internet "Knowledge" scale was composed of seven items describing knowledge of appropriate behavior on social networks and potential risk of Internet predators (Franek, 2005/2006; McKenna, 2007). The Knowledge items were intended to span a unidimensional, hierarchically ordered continuum consistent with the Rasch measurement model (Ludlow, Enterline, Cochran-Smith, 2008). It was expected that simple factual Internet actions would be easier knowledge items than ones requiring complex uses of Internet procedures and applications. Furthermore, success (i.e., "agree") on harder, more complex items was presumed to entail success on the easier ones. In this context, an item parameter estimate represents the "difficulty" of eliciting an agree response to a statement.

In contrast, the remaining items on the instrument were designed to identify whether or not students had experienced (e.g., Bully Victim, Parental Involvement) or exhibited specified behavioral attributes (e.g., Bully Behavior, Adult Notification, Internet Behavior). These dimensions were categorical and, hence, appropriate for a latent class analysis to further examine the construct validity of the score interpretations.

The Bully Victim dimension consisted of three items probing students' self-report of having been bullied through electronic means. An Agree response was scored as "1". Bullying Behavior was composed of seven items that directly queried the students on their bullying behaviors on both Myspace and instant messenger sites. For all items

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a response of Disagree was scored as “1” so that a high score would reflect a low degree of participation in the bullying behavior.

The Parental Involvement dimension consisted of three items which queried students on their parents’ awareness and participation in their Internet activities. Scoring the Agree response as a “1” resulted in high scores indicating higher levels of parental involvement. Internet Behavior was composed of three items with Agree scored as “1”, and was used to assess the extent that the respondents use the Internet for instant messaging, e-mail, or Myspace on a daily basis. Adult Notification was composed of three items with Agree scored as “1” to assess if the student would contact a parent or adult if they were threatened by a peer or stranger.

Validity. Content validity of the items was supported through the cyberbullying literature (Franek, 2005/2006; Hinduja & Patchin, 2009; McKenna, 2007; Shariff, 2008; Subrahmanyam et al., 2001) and judgmental review by N=5 middle school teachers and N=2 principals who actively work with bully behavior educational programs. Construct validity was examined through Rasch model and latent class analyses.

Rasch model. The Rasch model analysis served as a confirmatory test of the extent to which the knowledge items successfully defined a unidimensional, hierarchically ordered scale of Internet Knowledge of Internet risks. The construct validity of score interpretations for high and low scoring students was assessed by comparing the empirical ordering and spread of the item location estimates with the ordering expected under the theory guiding the development of the Knowledge scale. A complementary objective of the analysis was to examine item and person goodness-of-

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fit statistics, i.e., the extent to which the observed responses were expected under the model.

Latent class analyses. In traditional factor analysis, the latent variable is assumed to be normally distributed and measured on a continuous scale. Latent class analysis is "a qualitative analog to factor analysis" (McCutcheon, 1987) in which the latent construct is assumed to be categorical in nature. It is possible to specify more than one latent variable, each of which has two or more latent classes. For example, in the present study, we were interested in examining the relationship between cyber-bullying and cyber-victimization, as well as the proportions of students who would be classified as cyberbullies, cybervictims, both, or neither. To the extent that the data could successfully classify students into groups, support for the construct validity of score interpretations would be possible.

We specified 2 categorical latent variables: bully and victim, each of which contained two classes: behavior present or behavior absent. We ran a 2 categorical latent variable by 2 latent class model for the Bully Behavior and Bully Victim scales. Then, we ran a 2 categorical latent variable by 2 latent class model for the Adult Notification and Parental Involvement scales. Finally, we estimated a 2 latent class model for the Internet Behavior scale. We saved the most-likely class membership for each of the latent class analyses to generate the probability of class membership for each person within each class. Ideally, the probability of membership for the most likely class is much higher than the probability of class membership for the next most likely class, which would be considered support for construct validity.

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We then created a file that contained students' item level scores, the average proportion of questions that they endorsed on each of the 5 categorical dimensions, their average proportion of questions that they answered correctly on the Knowledge scale, and their most likely latent class memberships. Using the most likely class membership information, we were able to conduct follow-up analyses to determine whether there were differences among the classes of students in terms of their self-reported knowledge and experienced or exhibited behavioral attributes.

Reliability. The reliability of the data for the Knowledge scale was assessed by generating Cronbach's alpha internal consistency estimate. Because the remaining five categorical dimensions assessed by the survey were used in the latent class analyses for classification purposes only, no alpha reliabilities were generated.

Results and Discussion

Reliability of the Data

Cronbach's alpha for the Knowledge scores was .69. The use of the binary (Agree, Disagree) response format most likely contributed to the lower than desired reliability level because of the resulting restriction on item and scale variance. While the large sample size would contribute to a small confidence interval, the 95% confidence interval calculated using the central *F* distribution outlined by Fan and Thompson (2001) resulted in lower and upper limits for the reliability estimate of .67 to .71.

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Construct Validity

Rasch model analysis. A dichotomous Rasch model analysis, using WINSTEPS software (Wright & Linacre, 1998, version 3.68.0), provided evidence supporting the construct validity of the Internet Knowledge scale. Figure 1 presents the "variable map" containing the Internet Knowledge items. The left side of the figure shows the estimated knowledge level of each respondent on the logit scale. Each "#" symbol indicates the location for 21 students. The right side of the map lists the item numbers and statements, where items toward the top are "hard" to answer correctly ("agree"), while items at the bottom are "easy" to answer correctly ("agree").

INSERT FIGURE 1

The items are well spread across the Knowledge continuum, although items v25b, v12b, and v17b cluster together. The student locations also show a wide spread across the entire scoring range. A high score for a student, represented by a high positive logit estimate, corresponds to a high level of knowledge of appropriate behavior regarding the use of social network sites and the risks of Internet predators.

Proceeding upwards from the lower section of the variable map, it is easiest to agree with v2b (*Making threats online can get me into trouble with the police.)*, somewhat harder to agree with v7b (*An online predator could contact me using a social networking site like Myspace or Facebook if I posted my personal information on it.)*, harder still to agree with v15b and v19b (*An Internet predator can easily use Internet sites such as Google earth, MSN live or other programs to locate my school and house; Threats online that I carry out at school can get me in trouble.)*, and the cluster of items v25b, v12b, and v17b are the hardest items to agree with (*An Internet predator could*

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contact me based on what my friends have posted about me; With the contact information I put on Myspace or Facebook, it would be easy for an Internet predator to contact me; An Internet predator could make contact with me based on the information I have posted online.). This cluster of relatively hard items addresses the important issue of knowing that contact by an Internet predator can be made through personal information listed online. It is important to note that this ordering of items conforms to the hierarchical ordering of simple factual information to more complex inferences intended when the items were developed.

The difference between an observed response and an expected response may be expressed as a standardized residual (Wright & Stone, 1979). These residuals may be transformed into standardized, weighted fit statistics that are roughly analogous to *t* statistics and take into account the variance of the expected response (the so-called ZSTD INFIT in the WINSTEPS software). A criterion of +2 to +3 is often used initially, but because this statistic is easily influenced by sample size, we also checked the unstandardized mean square version (the so-called MNSQ INFIT) using a rough criterion of +1.3 to flag potential problems. These two summary statistics are generally sufficient to reveal consistent unexpected responses for both individual items and students. The standardized residuals, themselves, are useful for checking on the unidimensional structure of the scale and for understanding why individual items or people misfit the model.

Once the person “knowledge” and item “difficulty” parameters were estimated, the person-by-item standardized residual matrix was subjected to a principal component analysis as an additional check on the unidimensional structure of the scale. If the

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residuals are random, then such an analysis should yield eigenvalues all near 1.0, each eigenvalue accounting for an equal percent of the total variance, and any pair of plotted component loadings should yield a circular pattern of items spread around the origin (Ludlow, 1983). Finally, a parallel analysis using simulated residuals was run as a check on the interpretation of the empirical residual solution (O'Connor, 2000).

The results of the analysis of the obtained residuals and the parallel analysis of the simulated residuals were comparable and provide evidence of a unidimensional "knowledge" construct. Specifically, the first four empirical eigenvalues and variance estimates were 1.7 (23.2%), 1.2 (17.7%), 1.1 (16.1%) and 1.0 (14.6%) versus the simulated results of 1.2 (15.8%), 1.1 (15.5%), 1.1 (15.2%) and 1.0 (14.7%). The discrepancy on the first component is explained by the weak local dependency evident in items v25b, v12b and v17b (their mean residual inter-item correlation was .046). This finding is not surprising, since all three items address some aspect of being contacted based on information posted on the Internet. Finally, both plots of the first two Varimax rotated principal components from the empirical and simulated residuals revealed a circular pattern of items spread throughout all four quadrants, i.e., the residuals from the items were uncorrelated and did not cluster together.

Item v2b (*Making threats online can get me into trouble with the police*.) displayed noticeable misfit (MNSQ INFIT=1.86) due to an unexpected number of students who gave a surprising disagree response to a relatively easy item to agree with (see item difficulty location at the bottom of Figure 1; logit difficulty estimate = -2.11). In fact, the six most misfitting students on the scale had 6 of 7 correct answers, but their single incorrect answer occurred on item v2b—the easiest item to agree with. These students

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all had a high level of “knowledge” of appropriate behavior for the remaining six items defining the scale, but each one of them gave an unexpected disagree to this item. Examination of the demographic characteristics for these 6 students versus the remaining 1360 students suggests that the 6 students tended to: be males, be in grade 8, get into trouble in school more frequently, own a cell phone, and have a higher frequency of Internet use. These findings may suggest an interesting profile of the misfitting students, but they do not appear to suggest any threat to the validity of including item 2vb in the Internet Knowledge scale.

In addition to these checks on misfitting items and students, a differential item functioning (DIF) analysis was performed to check on the comparability of the male and female student responses (Holland & Wainer, 1993). A variety of procedures are possible for this form of analysis, and we employed a plot of the pairs of the item estimates and conducted statistical tests using the Welch and Mantel-Haenzel procedures in the WINSTEPS software. A Bonferroni adjustment was employed to maintain a family-wise error of alpha=.05 (.05/7=.007 per comparison).

These procedures revealed that female students tended to find both items v2b and v15b easier to agree with than males. Item v2b asks if making threats online can get one into trouble with the police—male students did not agree with this item as frequently as female students. Item v12b asks about knowing if an online predator could contact them using a social network like Myspace or Facebook. Males, again, did not agree with this item as frequently as females. Although the item difficulty estimates for males and females were significantly different, the relative order of these items for the males and females did not change along the continuum. Hence, the structural definition of the

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Knowledge scale is similar for both groups, thus further supporting the construct validity of score interpretations.

Latent class analysis. Using latent class analysis, we categorized all students in the sample into one of four latent class pattern groups listed in Table 1: they were bullies, victims, both, or neither. Approximately 74% (*n*=1,012) of the sample were neither bullies nor victims, 5% (*n*=69) were pure victims, 6% (*n*=82) were pure bullies, and 15% (*n*=203) were both bullies and victims. While some of these percentages seem small, the numbers of students involved help to quantify the degree of cyberbullying that is currently occurring in the 3 middle schools in this study.

INSERT TABLE 1

For the bully/victim analysis, the likelihood ratio chi-square test was not statistically significant ($\chi^2(990) = 843.01$), which indicated non-rejection of the null hypothesis that the model fit the data. In other words, there was not statistically significant model-data misfit. We took this as evidence that our 2x2 model fit the data reasonably well. We also examined the data for the average latent class probabilities for the most likely latent class combination. Overall, the predicted probabilities were quite high (above .80) for the most likely class combination, and quite low (below .13) for the other class combinations. The normative class (i.e., Neither Bully nor Victim) was the easiest class to classify: the average latent class probability for the normative class was .95.

Further analyses were carried out to examine if students classified into the four respective groups endorsed the items as predicted. Inspection of the item-level data indicated that the seven Bully Behavior items were far more likely to be endorsed by bullies and mixed (bully/victim) students, whereas the three Bully Victim items were far

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more likely to be endorsed by the victim and mixed (bully/victim) students. The students in the normative group were unlikely to endorse any of the 10 items from the two categories. These findings are consistent with theoretical expectations and provide support for construct interpretations.

Using the predicted class membership data for the four mutually exclusive groups listed in Table 1, we compared the four groups' scores for each of the dimensions that we created, and we found some interesting differences among the four groups. Table 2 contains the mean scores for each of the four groups on each of the dimensions. Because the items were dichotomous, a student-level mean of 0 occurs when a student did not endorse any of the items in that dimension, whereas a mean of 1 indicates that the student endorsed all of the items for that dimension. Thus, the group-level mean scores in Table 2 report the proportion of the items on the scale endorsed by the students in each of the four groups. (We rescaled the Bully Behavior dimension so that 0 is indicative of a lack of bullying behavior, whereas 1 indicates the student endorsed all of the bullying questions.)

INSERT TABLE 2

As would be expected, the normative group (Neither Victims nor Bullies, *n*=1012) had very low mean scores for both the Bully Victim (*M*=.05, *SD*=.11) and the Bully Behavior dimensions (*M*=.03, *SD*=.07). Those in the bully group (*n*=82) had high means on the Bully Behavior dimension (*M*=.42, *SD*=.13) and low means on the Bully Victim dimension (*M*=.00, *SD*=.00). Those in the victim group (*n*=69) had high means on the Victim dimension (*M*=.80, SD=.16) and low means on the Bully Behavior dimension (*M*=.05, *SD*=.07). Finally, those in the combined bully/victim group (*n*=203)

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had elevated scores on both the Bully Behavior dimension (*M*=.48, *SD*=.23) and the Bully Victim dimension (*M*=.64, *SD*=.27). These bully/victim status findings consistent with expectations are supportive of construct interpretations.

While not directly related to examining support for construct validity interpretations, several interesting descriptive findings were present that add to the bully literature. For example, the group means listed at the bottom of Table 2 indicate that the bullies, victims, bully-victims, and non-bully victims all had essentially the same degree of *knowledge* about Internet predators. There were no statistically significant differences across the four groups in terms of their Knowledge scores ($F_{3,\ 1351} = 1.87$, p=.13). But, the range of appropriate answers to the seven Knowledge items ranged from only .43 to .51 indicating an alarming low level of knowledge of risk associated with use of the Internet. However, the four groups differed in terms of their Internet *behaviors*. Bullies and bully/victims were less likely to report that they would notify adults about Internet bullying than the other two combined groups (t (477.1)= 10.68, p<.001, d=.66). In addition, bullies and bully/victims reported a lower degree of Parental Involvement than the other two groups (t (493.77) = 4.01, p<.001, d=.25). Finally, students who were either victims, bullies, or both reported using the Internet more frequently than those who were neither bullies nor victims (t (728.99) = 14.59, p<.001, d=.84)

In addition, a series of chi-square contingency table analyses run using the demographic variables revealed that the two bully groups were more likely to report getting in trouble in school (69% vs. 31%; χ^2 (1) = 67.0; p<.001; phi=-.22; Cramer's *V*=.22), a finding consistent with Carlson and Dewey's (2008) report that persistent bullies were more likely to get into trouble in school. Also, our two bully groups were

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less likely to report getting good grades (73.7% vs. 86.4%; χ^2 (1) = 26.2; *p*<.001; phi=-.14; Cramer's *V*=.14) than the two non-bully groups. This finding is consistent with DeVoe and Kaffenberger's (2005) reporting that the 2001 School Crime Supplement to the National Crime Victimization Survey found that fewer bullied students reported getting mostly A's than those not reporting or experiencing bullying at school.

The 2 categorical latent variable by 2 latent class model for the Adult Notification and Parental Involvement dimensions was less satisfactory in terms of model-data fit: the likelihood ratio chi-square test was statistically significant ($\chi^2(105) = 192.0$, *p*<.01) indicating poor model fit. The table of the average latent class probabilities for the most likely latent class pattern indicated that the model had the greatest difficulty classifying students who reported low levels of Adult Notification, but high levels of Parental Involvement (i.e., Wouldn't Tell/Parents Check column in Table 3). However, this subgroup was very small; it comprised only 2% of the sample. As we did for the bully/victim latent class data, we saved the predicted class membership data for each person in our data file on each of the two categorical latent class variables and used those to categorize the students into one of four mutually exclusive groups: those who were low on Adult Notification but high on Parental Involvement (i.e., Wouldn't Tell/ Parents Check; *n*=22; 2%), those who were low on both Adult Notification and Parental Involvement (*n*=568; 42%), those who were high on both Adult Notification and Parental Involvement (*n*=500; 37%), and those who were high on Adult Notification but low on Parental Involvement (*n*=274; 20%). Table 3 contains the mean scale scores for each of these four groups on all of our scales.

INSERT TABLE 3

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The students in the two high adult notification groups were less likely to report engaging in Bullying Behavior than the students in the two combined low adult notification groups (t *(977.00)*= 9.09, p<.001, d=.52) In addition, the students in the two high adult notification groups reported using the Internet less frequently (t *(1238.69)*=8.40, p<.001, d=.46) than the students in the two low adult notification groups. The students from the two high adult notification groups were slightly less likely to victims of cyberbullying (t (1170.74)=-3.04, p<.001, d=.17). Finally, the two high adult notification groups scored higher on the Knowledge subscale than the two low adult notification groups (t(1310)=8.23, p<.001, d=.45).

Using the highest predicted probabilities from the latent class analysis, we created two latent classes for Internet Behavior: a High Use class (n=745; 55%) and a Low Use class (n=619; 45%)**.** The average latent class probabilities for each of the two latent classes were quite high (>.95). Because there were only three items on the Internet Behavior dimension, the model was just identified. Therefore, the chi-square value and the *df* for this model were both 0. As depicted in Table 4, high frequency Internet users were more likely to be both bullies (t *(1164.61)*=12.65, d=.65, p<.001) and victims (t(1212.48)=10.67, d=.57, p<.001) than low Internet users. In addition, high frequency Internet users reported lower Parental Involvement (t*(1143.96)*=6.37, p<.001, d=.36) and had lower Adult Notification scores (t*(1299.65)*=7.38, p<.001, d=.40,) than low Internet users. High frequency Internet users also had slightly lower Knowledge scores (t(1226.18)=2.37, p=.02, d=-.13) than low frequency Internet users. Finally, chi-square contingency analyses of the demographic variables revealed that the high

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Internet users were more likely to report getting in trouble in school (53.7% to 39.8%; χ^2 (1) = 25.7; *p*<.001; phi=.138; Cramer's *V*=.138) and more likely to report having a cell phone (78.8% to 61.6%; χ^2 (1) = 48.5; *p*<.001; phi=.189; Cramer's *V*=.189) than the low Internet usage group.

INSERT TABLE 4

Educational Importance

Students' knowledge of risk of Internet predators, along with their bullying behavior and frequent use of instant messaging and social network sites, are important issues for creating safe school and home environments. Important findings of this research for schools were the relatively low levels of knowledge of risks on the Internet, the high incidence of bullying behaviors admitted by many students, and the indication by several students that they had been bullied. Our results indicated that almost three-quarters of the students in our sample (74%) reported they were neither bullies nor victims, but a closer examination of the data in Table 1 indicated that 21% or *n*=285 students were bullies or both bullies and victims and 15% or *n*=203 were both bullies and victims. In addition, 20% or *n*=272 students were victims. These are clearly alarming numbers supporting the rationale for the assessment of students' knowledge of cyberbullying risks and their Internet behaviors. School administrators, teachers and parents need to be aware of this issue and create educational opportunities to facilitate proper student knowledge and behaviors.

The measurement attributes of the instrument described support the use of the instrument to gather data to assist in this important educational effort. Not only is it

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possible to link a student's Internet Knowledge score to the specific items at that student's knowledge level, it is possible to measure change as progressive movement up the scale as more complex items are correctly addressed—ideally, as the result of an educational intervention.

At the local district and school building level, these data should be gathered to assess the extent that problems with the use of the Internet exist, and whether sub-groups or individual students are at risk. Use of the instrument as part of a state-wide assessment program would also be useful to assess the need for large scale educational efforts.

Post-print version of an article published in Educational and Psychological Measurement 71(1): 217-230.
doi:10.1177/0013164410387389

References

Carlson, L. W., & Dewey, G. C. (October, 2008). Differences between persistent and desistent middle school bullies. *School Psychology International*, *29*, 442-451.

DeVoe, J., F., & Kaffenberger, S. (July, 2005). *Student reports on bullying: Results from the 2001 School Crime Supplement to the National Crime Victimization Survey* (NCES 2005-310). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Erb, T. (2006). Cyberbullying: A growing threat to young adolescent well-being. *Middle School Journal*, *38*(2), 2.

Fan, X., & Thompson, B. (2001). Confidence intervals about score reliability coefficients, please: An EPM guidelines editorial. *Educational and Psychological Measurement*, *61,* 517-531.

Feinberg, T., & Robey, N. (2007, September). Cyberbullying. *Principal Leadership*, 10-14.

Franek, M. (2005/2006). Foiling cyberbullies in the new wild west. *Educational Leadership*, *63*, 39-43.

Post-print version of an article published in Educational and Psychological Measurement 71(1): 217-230.
doi:10.1177/0013164410387389

Gable, R. K., Ludlow, L. L., Kite, S. L., McCoach, D. B., & Filippelli, L. P. (April, 2009). *Development and validation of the Survey of Knowledge of Internet Risk and Behavior*. Paper presented at the annual meeting of the American Educational Research Association, San Diego.

Goodstein, A. (2007). *Totally wired*: *What teens and tweens are really doing online*. New York: St. Martin's Press.

Graham, J. M., Guthrie, A. C., & Thompson, B. (2003). Consequences of not interpreting structure coefficients in published CFA research: A reminder. *Structural Equation Modeling*, *10*, 142-153.

Hinduja, S., & Patchin, J. W. (2009). *Bullying beyond the schoolyard: Preventing and responding to cyberbullying.* Thousand Oaks, CA: Corwin Press.

Hinduji, S., & Patchin, J. W. (2010). Cyberbullying research center.http://cyber bullying.us/research.php

Holland, P. W., & Wainer, H. (1993). *Differential item functioning*. Hillsdale, NJ: LEA.

Horrigan, J. B. (2007). Home Broadband Adoption 2007. Pew Internet and American Life Project. Retrieved from http://www.pewInternet.org/PPF/a/105/about_staffer.asp

Post-print version of an article published in Educational and Psychological Measurement 71(1): 217-230.
doi:10.1177/0013164410387389

Jackson, A. (2009). New middle schools for new futures. *Middle School Journal, 40*, 6-10.

Lenhart, A. (2005). *Protecting teens online*. Washington, DC: Pew Research Center.

Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010). Social media & mobile Internet use among teens and young adults. Pew Internet & American Life Project. http://pewresearch.org/pubs/1484/social -media-mobile-Internet-use-teens-millennials-fewer-blog

Ludlow, L. H. (1983). *The analysis of Rasch model residuals*. Unpublished doctoral dissertation. University of Chicago, Chicago.

Ludlow, L. H., Enterline, S., & Cochran-Smith, M. (2008). Learning to Teach for Social Justice—Beliefs Scale: An application of Rasch measurement principles. *Measurement and Evaluation in Counseling and Development*, *20*, 194-214.

Ma, X. (2001). Bullying and being bullied: To what extent are bullies also victims? *American Educational Research Journal*, *38*(2), 351-370.

McCutcheon, A. L. (1987). *Latent class analysis*. Newbury Park, CA: Sage.

McKenna, P. (2007). The rise of cyberbullying. *New Scientist*, *195* (2613), 60.

Post-print version of an article published in Educational and Psychological Measurement 71(1): 217-230.
doi:10.1177/0013164410387389

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instrumentation, and Computers, 32,* 396-402.

Parsad, B., & Jones, J. (2005). *Internet access in U.S. public schools and classrooms: 1994-2003* (NCES 2005-015).U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Shariff, S. (2008). *Cyberbullying: Issues and solutions for the school, the classroom, and the home*. New York: Routledge.

Subrahmanyam, K., Kraut, R., Greenfield, P., & Gross, E. (2001). New forms of electronic media. In D. G. Singer, & J. L. Singer (Eds.), *Handbook of children and the media* (73–99). Thousand Oaks, CA: Sage.

Wright, B. D., & Linacre, M. (1998). *WINSTEPS*. Chicago: MESA Press.

Wright, B. D., & Stone, M. H. (1979). *Best test design*. Chicago: MESA Press.

Post-print version of an article published in Educational and Psychological Measurement 71(1): 217-230.
doi:10.1177/0013164410387389

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Logits   Persons - MAP - Items
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                      |  v25b   Predator could contact me based on friend's postings about me
                      |  v12b   Predator could easily contact me based on my Myspace/Facebook
             .######  |  v17b   Predator could contact me based on info I posted online about me
                      |
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       .############  |  v15b   Predator could locate my school/house using Google earth, etc
                      |  v19b   Threats online that I carry out at school can get me in trouble
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  -1                  +
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                   .  |  v7b    Predator could contact me if I posted on Myspace/Facebook
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                   .  |  v2b    Making online threats could get me in trouble with police
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Figure 1. Internet Knowledge Variable Map

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Table 1. Classification of Students as Bullies, Victims, Both, or Neither Based on Their Most Likely Latent Class Pattern

Latent Class Pattern	Classification	Class Count	Proportion
1, 1	“Pure” Bully	82	.06
1, 2	“Mixed”- Both Bully and Victim	203	.15
2, 1	Normative: Neither Bully Nor Victim	1,012	.74
2, 2	“Pure” Victim	69	.05

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Table 2. Scale Means Categorized by Bully/Victim Status: Proportion of Items Endorsed by Category

Dimension	Bully Only 6%, *n*=82		Both Victim and Bully 15%, *n*=203		Neither Victim nor Bully 74%, *n*=1012		Victim 5%, *n*=69	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bully Victim Score (1= endorses all)	.00	.00	.64	.27	.05	.11	.80	.16
Bully Behavior Score (1= endorses all)	.42	.13	.48	.23	.03	.07	.05	.07
Parent Involvement (1=highest involvement)	.12	.24	.23	.32	.28	.35	.30	.36
Internet Behavior (1=highest usage)	.73	.36	.78	.32	.43	.41	.70	.36
Adult notification (1=highest notification)	.29	.34	.34	.37	.59	.40	.62	.39
Knowledge (1= 100% correct)	.43	.23	.50	.25	.47	.28	.51	.25

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Table 3. Scale Means Categorized by Adult Notification and Parental Involvement Status: Proportion of Items Endorsed by Category

Dimension	*Would Tell/ Parents Check* 37%, *n*=500		*Would Tell/ Parents Don't Check* 20%, *n*=274		*Wouldn't Tell/ Parents Check* 2%, *n*=22		*Wouldn't Tell/ Parents Don't Check* 42%, *n*=568	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bully Victim Score (1= endorses all)	.14	.28	.15	.28	.29	.35	.19	.31
Bully Behavior Score (1= endorses all)	.07	.17	.09	.16	.26	.26	.18	.24
Parent Involvement (1=highest involvement)	.63	.27	.00	.00	.70	.10	.06	.13
Internet Behavior (1=highest usage)	.39	.40	.51	.40	.69	.39	.61	.41
Adult notification (1=highest notification)	.86	.20	.83	.17	.00	.00	.12	.16
Knowledge (1=100% correct)	.54	.28	.50	.28	.49	.30	.40	.25

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Table 4. Scale Means Categorized by Internet Behavior Class

Dimension	Internet Behavior Class			
	High Use 55%, *n*=745		Low Use 45%, *n*=619	
	Mean	SD	Mean	SD
Bully Victim Score (1= endorses all)	.24	.34	.08	.20
Bully Behavior Score (1= endorses all)	.18	.24	.05	.13
Parent Involvement (1=highest involvement)	.21	.30	.33	.38
Internet Behavior (1=highest usage)	.86	.19	.09	.15
Adult notification (1=highest notification)	.47	.40	.62	.40
Knowledge (1= 100% correct)	.46	.25	.49	.29

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