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Longitudinal patterns of involvement in cyberbullying: Results from a Latent Transition Analysis

Ruth Festl ^{a,*}, Jens Vogelgesang ^b, Michael Scharkow ^b, Thorsten Quandt ^c^a Deutsches Jugendinstitut e.V. (German Youth Institute), Department of Children and Child Care, Nockherstraße 2, 81541, München, Germany^b University of Hohenheim, Department of Communication, Frwirthstraße 49, 70599, Stuttgart, Germany^c University of Münster, Department of Communication, Bispinghof 9–14, 48143, Münster, Germany

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ABSTRACT

In the present study, we used Latent Transition Analysis as an innovative approach in cyberbullying research in order to detect multi-faceted involvement patterns. Since developmental aspects of cyberbullying are still poorly understood, we analyzed the stabilities and transition probabilities of these involvement patterns across time using longitudinal survey data. Based on a three-wave panel survey among 1723 pupils (12–15 years old), we identified a five-latent status model to best fit the data. Apart from a large group of non-involved pupils, there were four moderately to heavily involved cyberbullying classes, all characterized by a co-occurrence of perpetration and victimization experiences. We found two moderate and content-specific classes of cyberbullying: gossiping patterns that were predominant among girls and insulting patterns that rather appeared among male and lower-educated adolescents. Moreover, we revealed a heavily victimized group (with mild perpetration) and a very small class of heavy perpetrator-victims. Transition probabilities showed that cyberbullying behavior was quite stable over time.

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1. Introduction

Although cyberbullying research has increasingly consolidated in recent years, there still is an ongoing discussion on conceptual and measurement issues, and the empirical results based on these conceptual foundations. Many studies have investigated the prevalence, causes and consequences of cyberbullying, whereas the specific forms of cyberbullying have received less attention. Previously, Willard (2007) listed different forms of cyberbullying and cyberthreats, including harassment as repeated sending of insulting messages, denigration as destroying a person's social reputation and outing and trickery as publicly forwarding of personal information (p. 8–14). Based on this and other systematizations (partly derived from traditional bullying research), researchers have developed various lists of behavioral items, mostly in order to measure the intensity of cyberbullying involvement (for an overview see Kowalski, Giumetti, Schroeder, & Lattanner, 2014). In

contrast, only little empirical effort has been made to actually look at content-related emphases and different dimensions or patterns of cyberbullying involvement. Some studies indicated that, in addition to differences in the intensity of involvement, content-based emphases might be a valid criterion of distinction in cyberbullying research ("methods" of bullying, see Law, Shapka, Domene, & Gagné, 2012).

In the present paper, we focused on this multi-faceted understanding of cyberbullying and tried to identify qualitatively distinct patterns of involvement. Since developmental aspects of cyberbullying, i.e. the "careers" of bullies and victims, are still less well understood than in traditional bullying research, we additionally investigated the stability of these patterns and possible developmental trajectories using longitudinal survey data. Following recent methodological advances in bullying research (see Ryoo, Wang, & Swearer, 2015), we applied a longitudinal person-oriented approach called Latent Transition Analysis (LTA) to a large sample of high school pupils. Using this approach, we identified different cyberbullying patterns by taking into account inter-individual variations in the extent and form of cyberbullying involvement across time. We add to existing research not only by identifying these qualitatively different patterns of perpetration

* Corresponding author.

E-mail addresses: festl@dji.de (R. Festl), jens.vogelgesang@uni-hohenheim.de (J. Vogelgesang), michael.scharkow@uni-hohenheim.de (M. Scharkow), thorsten.quandt@uni-muenster.de (T. Quandt).

and victimization, but also by estimating the stability and transition probabilities of these cyberbullying involvement patterns over time.

2. Patterns of cyberbullying involvement

Generally, differences in prevalence data regarding involvement in cyberbullying may reflect real differences in person's socio-demographics and personal features, but can also be the result of methodological differences between studies such as methods of measurement.

2.1. Prevalence and measurement approaches

Previous studies on cyberbullying reported a wide range of prevalence rates. In a recent meta-analysis considering 80 empirical studies, Modecki, Minchin, Harbaugh, Guerra and Runions (2014) found variations in prevalence rates between 5 and 32 percent for perpetrators (on average 16%) and between 2 and 56 percent for victims of cyberbullying (on average 15%). Variations in prevalence rates may stem from differences in definitional issues, cut-off criteria regarding cyberbullying frequency (singular incident measures favoring overestimated rates vs. frequent incident measures favoring underestimated rates, e.g. Slonje & Smith, 2008), the set time frame (incident within the last six month, year, or at all), the samples referred to (age- or location-based differences, see Livingstone, Haddon, Görzig, & Olafsson, 2011), or the used measurement approaches (definition-based measures favoring underestimated rates versus behavior-based measures favoring overestimated rates, see Vandebosch & van Cleemput, 2009; for an overview see also Kowalski et al., 2014). Furthermore, if behavior-based measures are used, it needs to be discussed, which behaviors are indicative and how many behaviors need to occur in order to be classified as perpetrator or victim.

In traditional bullying, researchers have begun to use person-centered approaches that abstain from predetermined cut-off points and rather rely on observed response patterns. Thereby, the detected latent classes are allowed to differ according to various dimensions (e.g., the frequency and specific forms of involvement). Using Latent Class Analysis (LCA), Nylund, Bellmore, Nishina and Graham (2007) found that victims of bullying might be best classified according to the extent of their victimization, differentiating between victimized, sometimes victimized, and nonvictimized children. These classes were characterized by high, moderate or no indication of victimization, not depending on the particular form of the bullying (e.g., physical versus relational). The findings also showed that the size of the most victimized class decreased with growing age of the participants. Ryoo et al. (2015) explicitly looked at the changes of latent classes over time by estimating a Latent Transition Analysis (LTA). According to their results, latent statuses are characterized by the frequency (frequent, occasional, and infrequent) and by the form of involvement (cyberbullying versus traditional bullying). For victimization, they identified four (frequent victims, occasional traditional victims, occasional cyber and traditional victims, and infrequent victims), for perpetration three different latent statuses (frequent perpetrators, occasional verbal/relational perpetrators, and infrequent perpetrators). Their study also revealed that individuals usually transitioned into less frequently involved groups over time. Regarding their used method, they conclude that person-centered approaches are generally less prone to distortion and misclassification, since they use "response patterns of observed variables to assign individuals to unobserved latent groups" (Ryoo et al., 2015, p. 106).

Ryoo and colleagues already focused on the overlap of traditional bullying and cyberbullying. However, they separately

calculated traditional and cyber perpetration classes as well as traditional and cyber victimization classes, without considering the co-occurrence of perpetration and victimization throughout the contexts. Regarding cyberbullying, previous factor analyses, however, showed that many items measuring perpetration and victimization are influenced by one latent construct (Law, Shapka, Hymel, Olson, & Waterhouse, 2012; Menesini, Nocentini, & Calussi, 2011). Schultze-Krumbholz et al. (2015) performed a LCA that indicated the existence of exclusive classes, whose members were likely to report being either a perpetrator or a victim of traditional bullying. In contrast, it was shown that individuals involved in cyberbullying were likely to report that they had acted as perpetrator, but also suffered from being victimized. Schultze-Krumbholz et al. (2015) identified three cyberbullying groups with different degrees of involvement: non-involved (70%), bully-victims (26%) and perpetrators with mild victimization (4%). It became also clear that using person-centered clustering techniques such as LCA resulted in a more accurate detection of co-occurring cyberbullying perpetration and victimization patterns – compared to conventional (threshold-based) classifications that overestimated the prevalence of exclusive perpetrator and victim groups.

2.2. Individual differences

In addition to methodological differences, previous research has shown that involvement in cyberbullying varies with the age and gender of the respective persons. In a recent meta-analysis examining 122 effect sizes, Barlett and Coyne (2014) provided evidence that male adolescents were generally more likely to perpetrate cyberbullying. However, the meta-analysis also showed that this difference was strongly moderated by age. Specifically, female adolescents were more strongly engaged in cyberbullying during early and middle adolescence, while male perpetrators more likely acted as cyberbullies in later adolescence. Unlike the perpetration of cyberbullying, the role of age and gender for becoming victimized still is rather unclear. Based on a systematic review, Tokunaga (2010) concluded that female and middle-aged adolescents showed a high risk of suffering from victimization. Schultze-Krumbholz et al. (2015) found an overall stronger involvement in cyberbullying among older adolescents. Moreover, the researchers reported that females were more likely to be in the cyberbullying perpetrator-victim group, while males were more likely to be in the perpetrator-with-mild-victimization group. In a similar vein, Menesini et al. (2011) confirmed the existence of a perpetrator-victim pattern for both males and females, although females scored considerably lower on all cyberbullying items. In addition to age and gender, there are some hints in literature that the education level of adolescents might be an important influencing factor (see Festl & Quandt, 2016) that, however, has been rarely analyzed in cyberbullying research. Finally, many previous studies have found that traditional school bullying and cyberbullying involvement co-occur (e.g., Modecki et al., 2014; Vandebosch & van Cleemput, 2009; Walrave & Heirman, 2011). We therefore argue that previous involvement in traditional forms of bullying – either as perpetrator or victim – in school is expected to be associated with the different patterns of involvement in cyberbullying.

Previous studies have shown that some individual characteristics are associated with the level of involvement in cyberbullying. However, it is also known that different individuals, for example boys and girls (e.g., Archer, 2004; Björkqvist, Lagerspetz, & Kaukiainen, 1992) or also younger and older adolescents (e.g., Barlett & Coyne, 2014), use different aggressive behavioral strategies in order to position within the peer group and manipulate the according peer relationships. Therefore, different patterns

of involvement need to receive more attention in order to better understand the diffusion and underlying mechanisms of cyberbullying.

2.3. The present study

The main objective of the present study can be described two-fold: First, we strived to provide more insights into qualitative differences of cyberbullying by detecting different patterns of involvement taking into account inter-individual variations in the extent and forms of cyberbullying. Second, since longitudinal analyses in cyberbullying research are still scarce, we moreover looked at the developmental trajectories of these involvement patterns over time. In line with the ongoing methodological discussions and the recent developments in traditional bullying research, we decided to apply a person-centered clustering approach using Latent Transition Analysis, which allows discerning cyberbullying involvement patterns across different points of time. In contrast to Ryoo et al. (2015), we were particularly interested in the interrelation between cyberbullying perpetration and victimization, because it is known that these forms often co-occur (Schultze-Krumbholz et al., 2015). In detail, we aimed to answer the following three research questions:

- (RQ1) *How many and what kind of latent cyberbullying involvement patterns can be identified for each time point?*
- (RQ2) *How can the latent involvement patterns be characterized?*
- (RQ3) *How stable are the latent involvement patterns across time and what kind of transition patterns can be observed?*

3. Method

3.1. Participants and procedure

The study is based on a three-wave panel survey among high school students in the southwest of Germany. Before recruiting the schools, we checked for the compliance of the study design and questionnaire with valid ethical guidelines for school surveys and received approval from the federal Ministry of Education. The school sample was selected in order to cover the three different education levels in Germany (lower-, intermediate- and higher-track education schools) and also to include schools from urban and more rural areas. Depending on the active consent of their parents, all pupils between 7th and 10th grade from 33 schools were invited to participate in the study. In the present study, we focused on pupils in middle adolescence between 12 and 15 years old because this age group can be expected to be intensively exposed to and involved in cyberbullying (see also Tokunaga, 2010). The first wave sample comprised 4946 pupils. Of these students, 3344 also participated in the second wave one year later, resulting in an attrition rate of 32%. Of these remaining panelists, 54% also answered the questionnaire in the third panel wave, resulting in a final sample of 1802 respondents. The first panel wave was collected in 2013, the second in 2014, and the third in 2015. For all panel waves, the pupils answered a traditional paper-and-pencil approach during classes in school. The teachers were instructed carefully, in order to guarantee a standardized procedure of the survey in every class.

Comparing panel respondents with those who dropped out after the first two waves ($n = 3144$), we found significant differences in the socio-demographics of the pupils. Panel respondents were significantly more often female (56% compared to 48% dropouts, $\chi^2(1, N = 4936) = 23.96, p < 0.001$) and younger ($M = 13.3$ years compared to $M = 13.8$ years for dropouts, $t(4099) = 18.97, p < 0.001$), and they more often attended higher-track education

schools (66% compared to 53% dropouts, $\chi^2(1, N = 4944) = 90.41, p < 0.001$). Panel attrition is partly caused by the German school system, as lower-educated pupils usually leave school in ninth grade.

3.2. Measures

3.2.1. Cyberbullying involvement

In the questionnaire, we provided a brief definition of bullying and cyberbullying (following the definition of Smith, Mahdavi, Carvalho, Fisher, & Russell, 2008, p. 376). To measure involvement in cyberbullying, we used different behavioral criteria (derived from a systematization of Vandebosch & van Cleemput, 2009, p. 1352, p. 1352)¹ following the question "Sometimes things happen on the Internet or in school, by which somebody can get hurt. What are your personal experiences?" Using an 11-item battery with a frequency scale ranging from 0 (*never*) to 1 (*once*) and 2 (*occasionally*) to 3 (*often*), participants indicated how often during the previous year they had acted as perpetrators or had been victimized. Six items referred to the perpetration of cyberbullying ($\alpha_{t1} = 0.68; \alpha_{t2} = 0.71; \alpha_{t3} = 0.75$), and five items covered forms of online victimization ($\alpha_{t1} = 0.71; \alpha_{t2} = 0.71; \alpha_{t3} = 0.71$; see Table 1). All 11 items measured in all three panel waves served as manifest variables in the LTA. For the LTA, we used dichotomized items to ease the interpretation using thresholds (*never* and *once* coded as 0; *occasionally* and *often* coded as 1).

3.2.2. Traditional bullying involvement

In addition to age, gender, and level of education, we also controlled for the respondents' traditional bullying involvement. Participants reported how often during the previous year they had experienced each of the following four behaviors on a frequency scale ranging from 0 (*never*) to 3 (*often*): "How often during the last year have you spread rumors about one of your schoolmates"? "... have you destroyed the property of one of your schoolmates"? "... have you insulted one of your schoolmates"? "... have you pushed or beaten one of your schoolmates"? ($\alpha = 0.65$). Based on these items, we calculated a dichotomous threshold variable, indicating whether the pupils had perpetrated at least one of these forms either occasionally or often (coded as 1). To measure victimization in school, again a dichotomous variable was created (*never* and *once* coded as 0; *occasionally* and *often* coded as 1) using the following single item: "How often during the last year have you been bullied in school"? This mixed use of behavior-based and definition-based measures for traditional bullying perpetration and victimization had to be applied due to time and space constraints in the questionnaire, and needs to be considered, when interpreting the findings.

3.3. Data analysis

The used LTA approach is a longitudinal extension of LCA, which is a multivariate statistical model based on classical test theory (Collins & Lanza, 2010). LCA posits that an unobservable grouping variable can be inferred from a set of categorical indicators (in the present study, the 11 cyberbullying items per wave). In LCA, class membership is a time-stable characteristic, whereas class membership in LTA can change over time. Thus, LTA is ideally suited to describe longitudinal profiles of cyberbullying across time and estimate the stability of the latent status memberships. In order to have sufficient information about the pupils' cyberbullying

¹ We excluded two types of cyberbullying that Vandebosch and van Cleemput [3] suggested due to conceptual difficulties.

Table 1

Behavioral criteria of cyberbullying perpetration and victimization.

Perpetration	Victimization
Sending insulting messages (P1)	Receiving insulting messages (V1)
Writing insulting things on a public website (P2)	Embarrassing pictures or videos of oneself uploaded on the Internet (V2)
Uploading embarrassing pictures of someone (P3)	Receiving messages from a person with fake identity (V3)
Writing messages using fake identity (P4)	Rumors of oneself spread via the Internet (V4)
Spreading rumors on the Internet (P5)	Personal information forwarded by others (V5)
Forwarding personal information to others (P6)	

involvement, we restricted the analysis to all respondents who answered at least half of the perpetrator and victim items in each wave. This yielded an effective sample size of $n = 1723$. In order to account for the remaining item non-response, we used full-information maximum likelihood estimation (Enders & Bandalo, 2001).

We applied LTA in Mplus (version 7.11) and subsequently used established information criteria, such as the Akaike information criterion (AIC) and the Bayesian information criterion (BIC), as well as its corrected form to select from among a finite set of candidate models (Collins & Lanza, 2010). The BIC guided the model selection. The smallest BIC value indicates the model with the best fit to the data (Schwarz, 1978). To make the meaning of the latent statuses the same across time, we imposed equality restrictions on the item-response probabilities (Wang & Wang, 2012), which did not significantly decrease the model fit.

4. Results

4.1. Number and profiles of the latent status model

In order to determine the optimal number of latent statuses, we compared LTA models with latent classes ranging from two latent classes to six latent classes. Table 2 shows that the five-class model can be considered the best fitting and easiest to interpret model. This finding implies that five distinct statuses best represent adolescents' involvement in cyberbullying at each point in time.

Each of these five cyberbullying involvement statuses had a very specific profile. In line with previous findings, the largest group included pupils who are not involved in cyberbullying at all (83% in wave 1; see Fig. 1a). Moreover, we found a very small group of heavy perpetrator-victims who were strongly engaged as cyberbullies, but also reported high levels of victimization (1%). In addition to this extreme profile, we further identified a heavily victimized group of pupils who also showed some very mild forms of perpetration behavior, in fact the sending of insulting messages (4%). Finally, we found two other particular patterns of involvement characterized by moderate and content-specific cyberbullying patterns. One of these moderate perpetrator-victim groups mainly

suffered, because someone forwarded their personal information without consent, but they also acted the same way with third-party information. Moreover, the members of this class comparatively strongly agreed with writing and receiving fake-identity messages, pointing to an indirect cyberbullying involvement pattern. We subsequently designated this status as gossiping perpetrator-victims (7%). Members of the other moderate perpetrator-victim group almost exclusively reported that they had been victimized by insulting messages or – to a lower extend – had written insulting messages themselves. This status will be referred to as insulting perpetrator-victims (5%). Looking at the item agreement profiles across time (Fig. 1b–c), it appears that the described characteristics of each cyberbullying status became more pronounced in waves 2 and 3.

4.2. Specification of the latent status profiles

In a next step, we described the latent status profiles at the first panel wave by looking at their occurrence among male and female adolescents, different age and education groups as well as traditional bullying perpetrators and victims (see Table 3). In the gossiping status, we found a significant higher proportion of female and older adolescents who were also slightly more involved in traditional bullying as perpetrators and victims. In contrast, the insulting perpetrator-victim status was significantly more common among males who were also strongly involved as traditional perpetrators and especially already experienced victimization in school. A strong involvement in traditional bullying (especially school victimization) could be also confirmed for the heavily victimized latent status group. Additionally, no gender differences, but a significantly higher prevalence in the oldest age group (with a starting age of 15 years) were obtained for this latent status group. Finally, the very small class of heavy perpetrator-victims included significantly more males and older adolescents who exclusively came from intermediate- and higher-track education schools. Compared to the non-involved class, this particular group of adolescents displayed low rates of involvement as traditional perpetrators, but more intense traditional victimization experiences. The results are summarized in Table 3.

4.3. Prevalence and transition probabilities across time

Finally, we focused on the stability of and the changes in latent cyberbullying statuses over time. First, looking at the prevalence rates, the proportion of involved adolescents increased, especially between the first and second panel waves (Table 4). In the first panel wave, 83% of the respondents were classified as being non-involved in cyberbullying. During the next two years, only 76 percent of the pupils in T2 and T3 still did not report any involvement in cyberbullying. The number of gossiping perpetrator-victims (7%–13%) and heavy perpetrator-victims (1%–2%) clearly increased between the first and third panel wave. In contrast, the insulting perpetrator-victim and heavily victimized groups did not expand over time.

Table 2

Criteria for selecting the number of latent statuses regarding involvement in cyberbullying.

Number of Latent statuses	LL	Number of free parameters	AIC	BIC	aBIC	Entropy
2	-10086	27	20226	20373	20287	0.874
3	-9775	47	19644	19900	19751	0.862
4	-9633	71	19409	19796	19570	0.860
5	-9514	99	19225	19765	19451	0.864
6	-9435	131	19132	19847	19431	0.823

Note: Bolded status indicates the best-fitting model; LL = Log-Likelihood value; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = adjusted Bayesian Information Criterion.

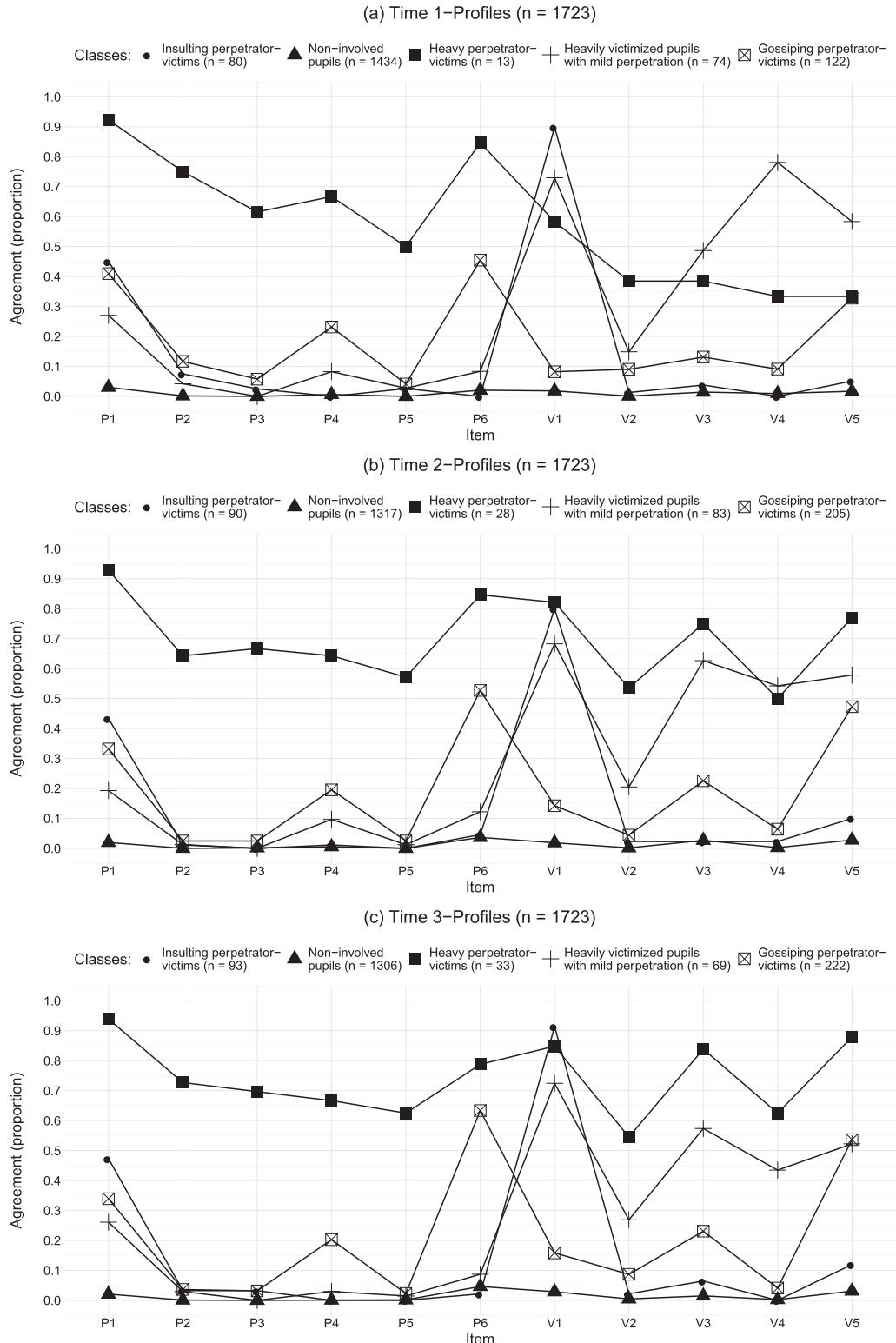


Fig. 1. a–c: Item agreement profiles for the five latent-status model across time. Note: The items (P = perpetrator; V = victim) had a dichotomous response category (indicated are the proportions of agreement for each class).

To investigate the stability of the latent cyberbullying statuses across time, we determined the transition probabilities between the panel waves (see Table 5). The diagonal bold elements within the transition matrices indicate the probability of staying in the same statuses between two consecutive measurement points. The non-involved group featured the most stable behavioral pattern.

Nearly nine out of ten adolescents stayed non-involved in cyberbullying, if they were in the non-involved group at time 1 or time 2. Likewise, the gossiping perpetrator-victim status appeared to be quite stable across time (77% T1–T2 and 72% T2–T3). If gossiping perpetrator-victims changed their behavioral patterns across time, they most likely transitioned into the non-involved group. Between

Table 3

Specification of the five-latent-status model of involvement in cyberbullying at time 1.

	Latent cyberbullying status				
	Non-involved (n = 1434)	Gossiping PV (n = 122)	Insulting PV (n = 80)	Heavily victimized with mild P(n = 74)	Heavy PV (n = 13)
Gender					
Female (56)	56	66	41	57	31
Male (44)	44	34	59	43	69
Age					
12 y. (21)	23	11	20	20	8
13 y. (39)	40	33	40	34	31
14 y. (31)	30	44	29	28	46
15 y. (9)	8	12	11	18	15
Education Track					
Lower-ability (5)	4	4	10	5	0
Intermediate (28)	28	24	30	31	54
Higher-ability (67)	68	72	60	64	46
Traditional Bullying Perpetration					
No Perpetrator (38)	41	30	21	24	62
Perpetrator (62)	59	70	79	76	38
Traditional Bullying Victimization					
No Victim (79)	83	72	49	44	69
Victim (21)	17	28	51	56	31

Values are indicative for column wise percentages; values in brackets refer to reference values for the total sample ($N = 1723$); PV = Perpetrator-Victim; P = Perpetration; Gender: $\chi^2(4, N = 1720) = 15.78, p < 0.01$; Age: $\chi^2(12, N = 1723) = 30.78, p < 0.01$; Education Track: $\chi^2(8, N = 1723) = 12.37, p = 0.14$; Traditional Bullying Perpetration: $\chi^2(4, N = 1723) = 25.51, p < 0.01$; Traditional Bullying Victimization: $\chi^2(4, N = 1702) = 114.77, p < 0.01$.

Table 4

Prevalence rates of the five-latent-status model of cyberbullying involvement across time.

	Latent status				
	Non-involved	Gossiping PV	Insulting PV	Heavily victimized with mild P	Heavy PV
Prevalences					
Time 1 83	7	5	4	1	
Time 2 76	12	5	5	2	
Time 3 76	13	5	4	2	

wave 1 and wave 2, 32 percent of the initial insulting perpetrator-victims switched into the gossiping involvement group. A transition between these two content-specific patterns could neither be observed between wave 2 and wave 3 nor the other way around from the gossiping to the insulting assignment. Thus, these types of

moderate involvement seem to represent two distinct forms of cyberbullying that are not interchangeable across time. Insulting cyberbullying patterns were more stable among older adolescents (83% T2-T3) compared to the first transition from T1 to T2 (52%).

Adolescents who were heavily victimized (and only perpetrated very mild forms on their own) often stopped being involved at all. In wave 3, 30 percent of them did not report about any remaining cyberbullying experiences. On the contrary, some heavily victimized pupils intensified their own perpetration behavior (7%) and were then assigned to the heavy perpetrator-victim group. Although being a heavy perpetrator-victim was quite a stable behavior between waves 1 and 2, it became far less stable between waves 2 and 3. Most of the intensively involved adolescents transitioned into the gossiping (28%) or heavily victimized group with milder perpetration (20%), but none of them to the insulting group after wave 1. The stability and transition patterns are summarized in Table 5.

Table 5

Transition probabilities of the five-latent-status model of cyberbullying involvement in across time.

	Latent status				
	Non-involved	Gossiping PV	Insulting PV	Heavily victimized with mild P	Heavy PV
Probability of transitioning to... Conditional on ... Time 1 Status					
...Time 1 Status					
Non-Involved					
Non-Involved	88	7	3	2	0
Gossiping PV	15	77	0	2	6
Insulting PV	3	32	52	9	4
Heavily victimized with mild P	21	2	9	68	0
Heavy PV	7	13	0	8	72
Probability of transitioning to... Conditional on ... Time 2 Status					
...Time 2 Status					
Non-Involved					
Non-Involved	87	8	3	1	1
Gossiping PV	23	72	0	0	5
Insulting PV	13	0	83	3	1
Heavily victimized with mild P	30	12	3	48	7
Heavy PV	12	28	0	26	34

Note: Percentages refer to the probability of transitioning latent class membership at the next time point, contingent on latent class membership at the previous point (T1-T2 above, T2-T3 below); bold percentage values along the diagonal of each matrix are indicative of stability in the specific class; PV = Perpetrator-Victim; P = Perpetration.

5. Discussion

We expanded previous research on cyberbullying by detecting and analyzing different longitudinal involvement patterns among adolescents using Latent Transition Analysis. Recently, following the methodological development in traditional bullying research, several researchers have begun to identify distinct classes of involvement in cyberbullying using person-centered clustering procedures such as LCA (see Schultze-Krumbholz et al., 2015). This seems promising, as it contributes to the ongoing discussion about appropriate methods of assignment and cut-off criteria leading to substantial differences in prevalence rates (Modecki et al., 2014). In line with the study by Schultze-Krumbholz et al. (2015), we also showed that cyberbullying could not be described in terms of active perpetration or passive victimization, but for most adolescents comprised both. In other words, we did not find any class that exclusively contained cyberbullying perpetrators or cyberbullying victims, although we did identify a heavily victimized class with only very mild forms of perpetration. In light of the results presented, we conclude that previous research has underestimated the proportion of perpetrator-victims (see also Schultze-Krumbholz et al., 2015). Compared to conventional variable-based classification approaches such as mean-based cut-off values, person-centered approaches such as LCA and LTA are better suited to identify particular response patterns and therefore provide classification results that are more precise. For example, Magidson and Vermunt (2002a, 2002b) showed that LCA misclassification rates were substantially lower than those obtained using traditional K-means algorithm.

In contrast to Schultze-Krumbholz and colleagues, we found that a model with five classes best fitted our data. This varying number of classes may be explained by sample- and measurement-related differences between the two studies. On the one hand, we have analyzed a narrower age group of pupils between 12 and 15 years old within one country. On the other hand, we have used dichotomous cyberbullying criteria differentiating between no involvement and repeated involvement in cyberbullying. In wave 1, 17 percent of the respondents were somehow involved in cyberbullying. The number went up to 24 percent two years later. This significant growth might be partly due to the overall increasing age of the adolescents, which was found to be a positive predictor of cyberbullying involvement (Modecki et al., 2014; Schultze-Krumbholz et al., 2015). We identified a very small group of intensive perpetrator-victims who scored at all cyberbullying items (even more pronounced at time 2 and 3). Despite the small number of adolescents, this class was clearly visible in all estimated models, even those with four or six latent status groups. It seems that in line with other specific groups in delinquency and problematic behavior research, there is a small class of adolescents with an intensive and stable problematic behavior (see for example research on gaming addiction, Festl, Scharkow, & Quandt, 2013). While this heavy perpetrator-victim class can be especially characterized by intensive perpetration behavior, we moreover found another small group of heavily victimized adolescents who only occasionally showed very mild forms of perpetration behavior. This latent status might most likely correspond to the pure victim group that has been identified in previous research using more conventional classification approaches (see Kowalski et al., 2014). Being a member of both heavily involved groups was more common among older adolescents.

In addition to these heavily involved classes, we identified two moderate, content-specific cyberbullying involvement classes: perpetrator-victims whose members were involved in gossiping cyberbullying, and perpetrator-victims whose members were involved in more overt insulting forms of cyberbullying. In line with

previous research on aggression, female adolescents were common in the gossiping status group, whereas males could be more often found among the (more direct) insulting perpetrator-victims (Archer, 2004; Björkqvist et al., 1992). Insulting forms of cyberbullying were also predominant among lower-educated pupils, which might reflect a stronger acceptance of aggression in these types of schools (see also Festl, Scharkow, & Quandt, 2015). As expected from previous research (Modecki et al., 2014; Vandebosch & van Cleemput, 2009; Walrave & Heirman, 2011), traditional bullying experiences were more pronounced in all cyberbullying-involved statuses. In particular, adolescents who were classified into the heavily victimized and insulting perpetrator-victim status were also more likely to report on victimization experiences in school. The highest proportions of traditional perpetrators were also found in these two latent status groups. This might be explained by the fact that for both latent statuses sending respectively receiving insulting messages was the main – and for the insulting status even the exclusive – form of perpetrating and experiencing cyberbullying. This more direct form of cyberaggression can be expected to comply with traditional forms of bullying, which might explain the found overlap. Surprisingly, the traditional perpetration experiences in the small problematic group of heavy perpetrator-victims were even lower than among the non-involved adolescents. This finding indicates that the bullying behavior of this intensive involvement group is mainly focused on the Internet. When interpreting these findings, it needs to be considered that traditional perpetration and victimization were measured using different approaches. As a consequence, the overall prevalence rates of traditional perpetration (62%; behavior-based approach) and victimization (21%; definition-based approach) differ. Although victimization rates might be underestimated due to the more constrained measurement, we did obtain substantial differences in victimization between the five latent statuses. These differences in victimization might have been more pronounced if we had applied a broader behavior-based measure.

Using LTA, we were not only able to identify different patterns of cyberbullying involvement, but also to trace these latent patterns across time. Looking at transition probabilities helps to better understand the 'career' of perpetrators and victims during adolescence. Unlike standard cluster analysis techniques, LCA and LTA are based on a statistical model which is postulated for a population from which the data sample is obtained (Magidson & Vermunt, 2002b). One advantage of the statistical model is that it makes decisions about the optimal number of clusters less arbitrary, since LCA and LTA provide formal criteria such as AIC or BIC to evaluate the number of classes (Collins & Lanza, 2010). Using LTA, we found that the large group of non-involved adolescents was highly likely to stay away from cyberbullying across time. This important finding shows that many adolescents grow up with online technologies without ever being directly involved in hurtful or humiliating incidents. Moreover, although the overall prevalence rates of cyberbullying increased with age, the heavily involved adolescents tended to transition into less frequently involved groups or – in the case of the heavily victimized status – even stopped being involved (Nylund et al., 2007; Ryoo et al., 2015). Thus, at least some adolescents being intensively victimized online had only been bullied episodically. Since being heavily involved was more common among older adolescents at the start of our study, we can assume that severe cyberbullying incidents peak during middle adolescence. A certain number of respondents also began to become involved in cyberbullying over time; they transited into the gossiping perpetrator-victim status. This transition pattern seems to be very distinct, as most of these pupils either stayed in this group or stopped being involved in cyberbullying.

Although the present study provided important and new insights, we also have to note some limitations. As with most cyberbullying research, the present data were based on self-report measures and found to be partly distorted by social desirability tendencies. In particular, when comparing the dropouts with the panel sample, we found that the latter generally were less involved in cyberbullying. Although a higher dropout of involved persons can be considered common in panel studies that focus on aggressive and deviant behavior (see [Thornberry, Bjerregaard, & Miles, 1993](#)) and might be partly explained by the enhanced dropout rate of older adolescents, who had previously been found to be more likely involved in cyberbullying (e.g., [Schultze-Krumbholz et al. 2015](#)), it needs to be considered when interpreting the findings. Due to time constraints within the survey, we also had to use different measures for traditional perpetration (behavior-based measure) and victimization (definition-based measure). This mixed approach has influenced the prevalence rates and might also distort the findings on the role of traditional bullying on cyberbullying involvement. Regarding the cyberbullying measures, we used different numbers of items for perpetration and victimization, as receiving insulting messages was not split by context. In general, when using a behavior-based measure, it always worth discussing whether the selected items are sufficient in order to cover cyberbullying involvement. The selection of our items was mainly guided by a systematization of [Vandebosch and van Cleemput \(2009\)](#). Finally, we used dichotomized cyberbullying items indicating whether or not a person was involved in cyberbullying at least occasionally. This cut-off criterion seems to be disputable, especially in the online context, where one singular message can be distributed easily and infinitely.

5.1. Conclusions

Our results illustrate that cyberbullying involvement includes complex and diverse patterns of behavior that need further reflection when analyzing the phenomenon and its underlying consequences. First, perpetration and victimization often co-occur, pointing to entangled behavioral spirals regarding cyberbullying involvement. This is in line with previous research, however, there still is only very limited information on processes underlying these co-occurring patterns. For example, it remains unclear if victims use perpetration strategies in order to take revenge for their own hurtful experiences or if perpetrators are no longer predominant in the anonymous online environment and therefore also become more likely to be victimized. Indeed, our results showed that at least for the moderate and content-specific perpetrator-victim statuses, form and intensity of perpetrated and experienced cyberbullying seem quite alike. If perpetrators and victims more often encounter each other at eye level, previous intervention strategies need to be reconsidered. It is also worth noting that acting as perpetrator in the cyberspace might not lead to a better status and a gain in reputation (as might be expected from traditional bullying), but more likely result in becoming victimized.

Second, our findings indicate that cyberbullying behavior has to be understood not only in terms of intensity (as has been done in most of the previous research), but also regarding its various forms. We identified four different cyberbullying involvement statuses, two of which were characterized by distinct content-related forms of cyberbullying. Moreover, these different statuses concerned distinct groups of adolescents and might also have different causes and consequences. Girls were overrepresented in the gossiping involvement group, which is characterized by attacking the social status and relationships of victims. In contrast, boys acting as cyberbullies were not focused on damaging social relationships, they rather sent hurtful and insulting messages. Future research needs

to more precisely examine these distinct patterns of cyberbullying involvement. A better understanding of the particularities of cyberbullying involvement is needed to develop tailored prevention and intervention strategies. This seems to be especially true for the very small group of heavy involved perpetrator-victims whose members urgently need special and individual treatment exceeding conventional intervention strategies in school such as group-based methods.

Third, looking at the transition probabilities of the latent statuses, we found that some adolescents constantly stayed in one (non-involved or involved) class, while others transitioned into less or more involved class. Moreover, we also found another group of respondents that even completely stopped being involved in cyberbullying over the course of our study. From a prevention and intervention perspective, these trajectories patterns of cyberbullying involvement across time provide important insights, as they can help to determine relevant risk but also protective factors. In a next step, we therefore aim to predict and explain these transition patterns, striving to get a deeper understanding as to why someone starts, stops or permanently stays involved in cyberbullying.

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