Pilot Evaluation Study of the Life Skills Program REBOUND: Effects on Substance Use, Knowledge About Substances, and Risk Perception

Henrik Jungaberle¹,² and Ede Nagy¹

Abstract
The main aim of the study is pilot evaluation of the life skills program REBOUND in a school context focusing on substance use, risk perception, and knowledge about psychoactive substances \( n_{IG+CG} = 723 \) students in five schools and 46 classes, \( M_{age} = 14.8 \), range [14-18] for the total sample and in the subgroups gender, age, and school type. Main goal of the study is collecting evidence for program optimization. A controlled study was carried out with repeated measurement before and after the intervention (4-6 months). Multilevel analyses, ANCOVA, and logistic regression analyses were applied to measure the effects. Overall, significantly lower incidence rates of drunkenness (odds ratio [OR] = .55; \( p = .033 \)), improved knowledge about psychoactive substances (\( p = .006 \)), lower personal (\( p = .013 \)) and general tobacco risk perception among users (\( p = .002 \)), and lower general tobacco (\( p = .018 \)) and cannabis (\( p = .000 \)) risk perception in non-users were found in the total intervention group. In subgroups, significantly lower rates for the incidence of drunkenness can be shown for males (\( p = .008 \)) and for younger participants (\( p = .004 \)). Students at academic high school (German Gymnasium) showed a decrease in 30-day prevalence for alcohol (\( p = .017 \)) and cannabis (\( p = .014 \)), and they improved in their knowledge about psychoactive substances (\( p = .000 \)). In vocational high school classes (German Realschule), there was an increase in the relative alcohol risk perception of the students (\( p = .019 \)). REBOUND contributes to a controlled use of alcohol and increases knowledge about psychoactive substances. REBOUND has various effects on the examined subgroups age, gender, and school type: Males, younger students, and students in academic high school benefitted more from the course regarding consumption-related criteria. We suggest a program optimization specific to school form and age, inclusion of a tobacco intervention, and the use of more gender-segregated interventions.

Keywords
life skills, risk education, addiction prevention, knowledge about psychoactive substances, risk perception, adolescence

Although most universal school-based prevention programs target students aged 6 to 13 (Foxcroft & Tsertsvadze, 2011; Thomas & Perera, 2006), fewer programs have been designed for the crucial phases of mid- to post-adolescence. Some programs focus on substance use, whereas others consider a larger set of psychosocial variables, such as life skills or multiple problem behaviors (Botvin, Griffin, Paul, & Macaulay, 2003). Existing programs only aiming to reduce older adolescents’ consumption of psychoactive substances have so far been shown to be less effective than interventions for younger students (Foxcroft & Tsertsvadze, 2011; Malwald & Reese, 2000; Thomas & Perera, 2006; Tobler et al., 2000). Positive effects shown in meta-analyses included a decrease in frequency of drunkenness and “binge drinking” in the age group of 13 years and younger (Botvin et al., 2003; Faggiano et al., 2005; Poduska et al., 2008). Still, the development of interventions for older adolescents is desirable, because the readiness for experimentation, risk taking, and related social costs increase at this age.

Concepts and Challenges in Promoting Risk Competence
The life skills program REBOUND targets the age group of 14- to 25-year-olds. REBOUND aims at providing primary prevention for non-consumers as well as secondary prevention for consumers. To achieve this goal, REBOUND focuses

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on the promotion of life skills and risk competence (Fahrenkrug, 1998; Franzkowiak, 1996; Löwe, Braun, & Kissner, 2008) in the consumption of alcohol and other drugs.

Risk competence is a life skill and as such is important in preventing and reducing maladaptive coping strategies known to be a major factor in developing addiction (Jessor & Jessor, 1977; Lazarus & Folkman, 1984; Resch, 1999; Silbereisen & Reese, 2001). It is a self-regulative strategy sensu Bandura (2005) and can be seen as a part of health behavior (Ajzen, 1991; Becker, 1974).

Four dimensions were hypothesized as constituting risk competence: (a) self-reflection and risk reflection, (b) verifiable knowledge about psychoactive substances and their use, (c) control, that is, the intention to and success with limiting one’s use, and (d) an orientation toward positive goals in the future that exclude destructive substance use.

Challenges for the promotion of risk competence are for example delaying the onset of use, which is an important predictor for later addiction (Chou & Pickering, 1992; Laucht & Schmid, 2007; Lynskey et al., 2003; Robins & Przybeck, 1985). Others are the heterogeneous consumption habits at this age, differences in gender, and school-form consumption patterns that need to be considered for intervention and call for the analysis of subgroups in evaluation (Rothwell, 2005).

For example, male gender is associated with higher consumption of psychoactive substances (Kulis, Yabiku, Marsiglia, Nieri, & Crossman, 2007; Lev-Ran, Le Strat, Intiaz, Rehm, & Le Foll, 2013; van Etten & Anthony, 2001).

The participants of the present study were from vocational high school (Realschule) and academic high school (Gymnasium). Studies have shown different prevalences of substance use at different types of schools (Bundeszentrale für gesundheitliche Aufklärung, 2012; O’Malley, Johnston, Bachman, Schulenber, & Kumar, 2006).

Hypotheses

We assume that the participation in REBOUND has a positive effect on risk competence that will lead to no or a decreased consumption of alcohol, tobacco, and cannabis; promote adequate risk perception; and increase participants’ knowledge about psychoactive substances. In addition, we examine whether the reported effects in predefined subgroups hold for REBOUND; that is, participants benefit more from the program, when they are younger, female, and students at academic high school.

Method

Study Design and Setting

A controlled study with repeated measurements was conducted in southern Germany from September 2011 to July 2012. In this naturalistic field study, the intervention group (IG) consisted of school classes (ninth and 10th graders) taking part in the program over a period of 4 to 5 months. The control group (CG) consisted of classes of the same age group. Twenty-nine course instructors were trained for the pilot phase and implemented the program for their first time. Due to the number of participating schools in the program’s developmental phase, randomization in this quasi-experimental design was conducted by classrooms, rather than by the low number of schools in the development phase and did not succeed in all cases, due to the practical fact that some schools were not able to adjust their class schedules in such a way that the REBOUND teachers could be assigned to the randomized classes. Blind randomization was not possible because students, parents, and trainers would know which group participated in REBOUND and which did not.

The survey was conducted online using EFS-Survey 8.1 (Décieux, Heinz, & Jacob, 2011). It took place within 1 week before and after the intervention (M processing time 29 min; SD = 6.6). Response to all questions was mandatory with the exception of irrelevant subordinate questions.

Intervention

The 16 units of REBOUND were integrated into school curricula and taught in weekly sessions of 90 min. The sessions were facilitated by trained course instructors teaching at the participating school. They were optionally assisted by peer mentors. The intervention is described in detail in Kröninger-Jungaberle, Nagy, von Heyden, DuBois, and the REBOUND Participative Development Group (2014).

REBOUND integrates best-practice elements, such as promotion of life skills, information about psychoactive substances, the use of peer mentoring, and normative education (Cujpers, 2002; Hawks & Scott, 2002; Tobler, et al., 2000). In addition, its developers created innovative methods, most notably “explorative film work” consisting of joint scenario analysis of videos depicting risk behaviors in realistic context. The latter is based on Bandura’s (2005) self-regulation approach and aims to enhance cooperation and risk assessment among students. In the course of the sessions, health-promoting norms are identified by reflecting healthy and harmful cognitive-emotive and behavioral patterns. For example, the classroom would frequently talk about the ability to take a conscious break from weekly alcohol consumption or the necessity of training general self-control, body awareness, and peer-pressure resistance skills, if thinking about trying a psychoactive substance.

Measures

Our large questionnaire contained five different groups of items relating to socio-demographic variables, substance use, risk perception, knowledge about psychoactive substances, and possible confounding covariates.

The following socio-demographic variables were collected: school type, gender, age, housing, family setting, pocket money,
parents’ occupation, recreational activities, and satisfaction with school performance. Satisfaction with school performance was measured using a 7-point Likert-type scale ranging from 1 = not at all satisfied to 7 = very satisfied.

The frequency of alcohol, tobacco, and cannabis use was measured by lifetime, 6-month-, and 30-day prevalence. The information concerning the 6-month prevalence was gathered using a 7-point Likert-type scale ranging from 0 = not at all to 6 = 40 times or more. Thirty-day prevalence was equivalent to the number of consumption days in a month (0 to 31). In addition, frequency of drunkenness and binge drinking were ascertained for the last month. Binge drinking was defined as the consumption of at least five alcoholic drinks in one occasion. Finally, the intensity of last alcohol intoxication was measured on a 7-point Likert-type scale ranging from 1 = only slightly tipsy to 7 = so drunk that I could hardly remain standing on my feet. The items were adapted from a survey among 12- to 25-year-olds in Germany conducted by the Federal Centre for Health Education (Bundeszentrale für gesundheitliche Aufklärung, 2012).

Three different kinds of risk perception were measured: the general—“how risky is it for everybody?” personal—“how risky is it for me?” and relative—“how risky is it for me compared with for other people?” These were assessed for use of alcohol, tobacco, and cannabis. We also asked non-consumers about their perception of the risk for the general population. All were done using a 7-point Likert-type scale ranging from 1 = harmless to 7 = very dangerous.

We developed a 40-item test to assess knowledge about alcohol, tobacco, cannabis, and psychoactive substances in general with 10 items for each category (e.g., nicotine improves concentration and short term memory; answers given as true,” not true, do not know). The do not know answers were counted as wrong answers. Cronbach’s alpha for the total scale was .80 before and .85 after the intervention.

The following covariates were measured on a 5-point Likert-type scale from 1 = not at all true to 5 = absolutely true: normality of the consumption of alcohol, tobacco, and cannabis in the peer group (e.g., drinking of alcohol is completely normal in my peer group), parental acceptance of one’s own use of alcohol, tobacco, and cannabis (e.g., for my parents, it’s ok, if I smoke), not being liked by peers (I am not liked by other kids), being bullied (other students often make fun of me), behavioral problems in school (I have had frequent problems in the school, e.g., fighting, disturbing the lesson), perceived bio-psycho-social stress (compared with other people my family and I have more problems such as divorce, illness, financial problems), and the perceived relationship with parents (in general, I have a good relationship with my parents).

**Study Sample**

We were able to include 1,148 students in 48 school classes in five schools in the quasi-experimental design. Twenty-three students chose not to participate. IG: n = 679 students in 29 school classes, CG: n = 446 students in 19 school classes. The sample was constituted by students of academic and vocational high schools; other German school types were underrepresented (n = 16 students) and therefore excluded.

The quasi-experimental design resulted in a lack of equivalence between IG and CG regarding a number of variables. Hence, propensity score matching (Rosenbaum & Rubin, 1983) was carried out to achieve equivalence between IG and CG, using the “nearest” algorithm of the R-package “MatchIt” within the framework of the statistical software R2.15.2 (Ho, Imai, King, & Stuart, 2011). This achieved equivalence on all test variables except “amount of pocket money a month” (MIG = 32.2 Euro, MC8 = 26.9 Euro; T = −2.49, p = .013; see Table 1). Due to the matching procedure, the sample decreased by 126 persons (11.8% of the total sample) and two classes. The analyzed sample became after Attrition as follows: n = 723, 48.1% male, 51.9% female, M age: 14.8 years (median = 15; SD = .74, range = 14–17), school type: vocational high school: 48.7%, academic high school: 51.3% (see Figure 1).

**Multilevel structure.** The data have a hierarchical structure (Level 1 = students, Level 2 = classes). Because of the similar context, higher correlations within the classes were expected than between them (intraclass correlation coefficient [ICC] p). Therefore, at first, the ICC of the study variables (difference values between the pre- and post-measurements: T2-T1) was computed. This procedure was necessary to calculate the design effects (DE), so that the appropriate analytical methods could be determined (conventional vs. multilevel analyses). DE is a function of the ICC and the average cluster size (m), which allows adjusting the sample size at excessive ICC. DE is calculated according to the formula 1 + (m − 1) × p. In the case of a DE > 2, the application of a multilevel analysis is recommended (B. O. Muthén & Satorra, 1995). In addition, determining the ICC was necessary for the post hoc calculation of the discoverable effect sizes for hierarchical data. For two covariates and five dependent variables, DE > 2 was found. The rest of the variables yielded an average ICC after Fisher’s Z transformation of .024 (min: .00, max: .066). The ICC and DE are shown in Tables 2 and 3 in the two columns on the right side.

**Control of Covariates**

To statistically control the influence of covariates on the relationship between group membership and intervention effects, covariates were selected that showed a high correlation with at least three of the dependent variables, but low correlations among each other.

These conditions were met by the following 11 variables, which were subsequently used as covariates: type of school (due to no variance at the cluster level not used in multilevel regression analysis [MLA]), gender, traditional family setting (living with both biological parents), high socioeconomic status, satisfaction with school performance, leisure...
Table 1. Comparison and Characteristics of the Intervention and Control Group After the Propensity Score Matching.

|                      | CG (n = 211) | IG (n = 512) | Statistics (df) | p   | ICC | DE |
|----------------------|--------------|--------------|-----------------|-----|-----|----|
| **School type**      |              |              |                 |     |     |    |
| Junior high school   | 114 54       | 238 46.5     |                 |     |     |    |
| Academic high school | 97 46        | 274 53.5     |                 |     |     |    |
| **Gender**           |              |              |                 |     |     |    |
| Male                 | 109 51.7     | 239 46.7     |                 |     |     |    |
| Female               | 102 48.3     | 273 53.3     |                 |     |     |    |
| **Age in year**      | 14.8 0.8     | 14.8 0.7     | t(721) = .69    | .483|     |    |
| 14                   | 73 34.6      | 186 36.3     |                 |     |     |    |
| 15                   | 101 47.9     | 246 48       |                 |     |     |    |
| 16                   | 32 15.2      | 71 13.9      |                 |     |     |    |
| 17                   | 5 2.4        | 9 1.8        |                 |     |     |    |
| **Lifetime prevalence** |          |              |                 |     |     |    |
| Alcohol use          | 156 73.9     | 368 71.9     | χ²(1) = .31     | .573|     |    |
| Tobacco use          | 65 30.8      | 174 34       | χ²(1) = .68     | .409|     |    |
| Cannabis use         | 18 8.5       | 47 9.2       | χ²(1) = .08     | .782|     |    |
| Drunkenness          | 59 37.8      | 155 41.9     | χ²(1) = .75     | .385|     |    |
| 30 days’ prevalence of use (in days) |       |              |                 |     |     |    |
| Alcohol              | 2.2 3.4      | 1.8 0.29     | t(346) = 1.75   | .100| .07 | 2.05|
| Binge drinking       | 0.53 1.1     | 0.47 0.97    | t(349) = .71    | .477| .07 | 2.1 |
| Drunkenness          | 0.35 1.1     | 0.29 0.85    | t(721) = .75    | .454| .02 | 1.3 |
| Tobacco              | 2.1 5.9      | 2.1 6.1      | t(721) = .03    | .975| .03 | 1.5 |
| Cannabis             | 0.6 0.27     | 0.07 0.52    | t(721) = .42    | .682| .03 | 1.51|
| 6 months’ prevalence of use (scale 1-7) |       |              |                 |     |     |    |
| Alcohol              | 1.9 1.8      | 1.6 1.6      | t(362) = 1.71   | .071| .03 | 1.38|
| Tobacco              | 0.8 1.7      | 0.8 1.7      | t(721) = .16    | .874| .07 | 1.98|
| Cannabis             | 0.1 0.32     | 0.1 0.5      | t(614) = .16    | .164| .02 | 1.35|
| Intensity of the last drunkenness (scale 1-7) |       |              |                 |     |     |    |
| Alcohol              | 4.3 2        | 4.1 1.7      | t(90.2) = .5    | .615| .00 | 1.04|
| Tobacco              |               |              |                 |     |     |    |
| Cannabis             |               |              |                 |     |     |    |
| General              |               |              |                 |     |     |    |
| General risk perception among users |         |              |                 |     |     |    |
| Personal             | 2.1 1.4      | 2 1.3        | t(524) = .83    | .406| .00 | 1   |
| Relative             | 2.3 1.3      | 2 1.3        | t(524) = 1.32   | .186| .00 | 1.1 |
| General              | 4.6 1.4      | 4.6 1.4      | t(524) = .62    | .535| .02 | 1.3 |
| Tobacco risk perception among users |         |              |                 |     |     |    |
| Personal             | 2.3 1.7      | 2.6 2        | t(240) = .1     | .325| .02 | 1.35|
| Relative             | 2.3 1.7      | 2.2 1.6      | t(240) = .6     | .554| .00 | 1.08|
| General              | 4.9 1.7      | 5.2 1.6      | t(240) = .59    | .291| .07 | 2.13|
| Cannabis risk perception among users |         |              |                 |     |     |    |
| Personal             | 2.8 2.3      | 2.1 1.5      | t(23.5) = 1.2   | .165| .00 | 1.1 |
| Relative             | 2.4 1.7      | 2.3 1.4      | t(63) = .46     | .648| .23 | 4.4 |
| General              | 4.3 2        | 4.2 2        | t(63) = .16     | .876| .03 | 4.4 |
| General risk perception among non-users |         |              |                 |     |     |    |
| Alcohol              | 5.1 1.2      | 5 1.2        | t(198) = .68    | .494| .03 | 1.44|
| Tobacco              | 6.1 1        | 5.9 1.3      | t(344) = 1.8    | .07 | .02 | 1.25|
| Cannabis             | 5.9 1.5      | 5.8 1.4      | t(657) = .403   | .687| .04 | 1.61|
| Knowledge about PAS  | 16.2 5.7     | 15.5 5.7     | t(721) = 1.36   | .173| .07 | 2.07|
| Satisfaction with own school achievement | 3.4 1.3 | 3.4 1.4 | U = 54,004 | .996 | .10 | 1.15 |
| **Pocket money in Euro** | 26.9 20.5   | 32.2 35.5    | t(650.5) = −2.49| .045$|     |    |
| **Leisure activities** |           |              |                 |     |     |    |
| Alone                | 7 3.3       | 24 4.7       | χ²(1) = .68     | .408|     |    |
| With friends at home | 168 79.6    | 389 76       | χ²(1) = 1.12    | .290|     |    |
| With friends in the disco, pub, or café | 70 33.2 | 165 32.2 | χ²(1) = .06 | .804|     |    |

(continued)
activities, normality of tobacco use among friends (due to DE > 2 used only in MLA), being bullied, behavioral problems in school, and perceived bio-psycho-social stress level.

For the subgroup analyses with a reduced number of variables, the eligibility conditions were met by the following four variables: higher status parental occupation, normality of cannabis use among peers, parental acceptance of students’ tobacco use, and leisure activities in disco, bar, or café.

Data Analysis

Total sample analysis. Because of the nested data structure, MLAs (analysis type = two level) were applied using the software Mplus 5.21 (L. K. Muthén & Muthén, 1998) for the analysis of intervention effects on the five dependent variables (DV) with DE > 2. For each DV, a difference value of pre- and post-measurement was calculated to reflect the individual change in the outcome variables. In the MLA, a fixed-effect model was used with a dummy-coded predictor (group) and random intercept specified for each DV. The influence of covariates was statistically controlled in the model.

For dependent variables with a DE < 2, we applied univariate analyses of covariance and logistic regression analyses using SPSS 0.20. Logistic regression analyses including group as the predictor and the covariates were used for the analysis of intervention effects on the incidence rates of alcohol, tobacco, cannabis, and drunkenness. The intervention effects on the pre–post difference values of continuously scaled variables were examined using fixed-factor group ANCOVAs.

Subgroup analyses. The sample was divided into subgroups: gender, age (aggregated samples of 14- to 15-year-olds and 16- to 17-year-olds), and school type (vocational and academic high school). Alpha error accumulation in multiple tests was countered by reducing the number of consumption variables. The 30-day prevalence of alcohol, tobacco, and cannabis use and the lifetime prevalence of drunkenness were included in the analyses.

The following variables did not show equivalence between IG and CG before the course (T1) and were excluded: 30-day prevalence of alcohol in the subgroup of vocational high school students ($M_{IG} = 1.93, M_{CG} = 2.99, t = 2.45, df = 174.5, p = .015$), lifetime prevalence of drunkenness ($rate_{IG} = 44.4\%, rate_{CG} = 30\%, \chi^2 = 4.42, df = 1, p = .035$), and 30-day prevalence of tobacco use in the subgroup of academic high school students ($M_{IG} = 1.53, M_{CG} = .64, t = −2.1, df = 281.6, p = .033$); personal alcohol risk perception in the subgroup of males ($M_{IG} = 2.03, M_{CG} = 2.51, t = 2.43, df = 130.15, p = .016$), relative alcohol risk perception in the age group of 14 to 15 years old ($M_{IG} = 2.07, M_{CG} = 2.35, t = 2.03, df = 429, p = .043$), overall alcohol risk perception in non-drug users ($M_{IG} = 4.73, M_{CG} = 5.75, t = 3.02, df = 21, p = .007$), and general cannabis risk perception in drug users ($M_{IG} = 3.85, M_{CG} = 6.00, t = 3.19, df = 15.92, p = .006$) in the age group of 16- to 17-year-olds.
Only those subgroups are suitable for analysis in which significant interaction effects can be found (Brookes et al., 2001). First, interaction effects were examined between gender, age, and school type as well as between membership in the IG and CG. ANOVAs and logistic regression analyses were conducted.

Some variables were dichotomous such as “drunkenness” (yes/no). The incidence rate of these was calculated using logistic regression analyses. Again, we controlled for the influence of the four covariates. In each subgroup, seven tests were carried out, which contributed to the accumulation of the alpha error. Thus, sequential Bonferroni correction sensu Holm (1979) was used, which is less conservative than the usual Bonferroni correction.

Results

Attrition

Of the total sample (N = 2,153 pre- and post data sets in the IG and CG), 709 (36 %) student data sets were missing (nIG = 284; 21.7%; nCG = 425; 50.2%). From these, 15.3% were caused by having no match between pre- and post-data due to absent or deviant identification codes. In all, 5.9%
were missing due to response bias (e.g., processing time less than 10 min, response tendencies) and implausible responses (pocket money, for example, 9,999 Euros). Finally, 11.7% were excluded by the propensity score matching. There was evidence of systematic dropout comparing the analysis sample (N = 854) with the dropout sample (N = 276). Students who dropped out were older, t(402) = −4.69, p = .000; more likely to be male, χ²(1) = 26.8, p = .000; more likely to be from vocational high school, χ²(1) = 4.52, p = .033; or spent more of their recreational time with friends at home, χ²(1) = 4.92, p = .017, or in the disco or café, χ²(1) = 5.46, p = .012. They also had more behavioral problems in school (U = 94,158.5).

### Table 2. Results of the Multilevel Regression Analyses: Intergroup Effects on the Dependent Variables (T2-T1) with EN > 2.

| Intervention effects on . . . | IG | CG |
|-------------------------------|----|----|
|                               | M  | SD | M  | SD | B  | SE  | p   |
| 30 day's prevalence of use (in days) |    |    |    |    |    |    |    |
| Alcohol                       | 1.2| 3.6| 0.64| 3.75| 0.609| .484| .208|
| Binge drinking                | 0.67| 1.49| 0.84| 1.59| −0.159| .231| .491|
| General tobacco—risk perception among users | −0.22| 1.78| 0.48| 1.44| −0.647| .278| .020*|
| Relative cannabis—risk perception among users | −0.26| 1.8| −0.47| 2.56| 0.242| .588| .680|
| Knowledge about psychoactive substances | 1.65| 6.03| 0.30| 4.79| 1.336| .483| .006***|

Note. IG = intervention group; CG = control group.
* p < .05. ** p < .01.

### Table 3. Results of the ANCOVA: Intervention Effects on the Change (T2-T1) in Substance Consumption, in Risk Perception, and in Knowledge About PAS.

| Difference T2-T1 | CG (n = 211) | IG (n = 512) |
|------------------|--------------|--------------|
|                  | n | M  | SD | n | M  | SD | AMD | Partial η² | df | F   | p   |
| 30-day frequency of use (in days) |    |    |    |    |    |    |    |    |    |    |    |
| Drunkenness      | 73 | 0.63| 2.58| 168| 0.48| 2.09| −0.04| .000| l | 0.013| .910|
| Tobacco          | 47 | 1.66| 8.44| 123| 2.11| 7.38| .69 | .000| l | 0.003| .959|
| Cannabis         | 15 | 1.13| 1.17| 53 | 1.11| 2.60| .20 | .001| l | 0.071| .791|
| 6-month frequency of use (Scale 1-7) |    |    |    |    |    |    |    |    |    |    |    |
| Alcohol          | 164| 0.40| 1.23| 371| 0.41| 1.28| .004| .000| l | 0.001| .971|
| Tobacco          | 66 | 0.14| 1.64| 180| 0.23| 1.51| .009| .001| l | 0.002| .968|
| Cannabis         | 22 | 0.64| 1.14| 67 | 0.46| 1.25| −0.09| .001| l | 0.093| .761|
| Intensity of the last drunkenness (scale 1-7) |    |    |    |    |    |    |    |    |    |    |    |
| Alcohol          | 43 | 0.42| 2.14| 126| 0.13| 1.83| −0.20| .002| l | 0.337| .562|
| Tobacco          | 164| 0.40| 1.23| 371| 0.41| 1.28| .004| .000| l | 0.001| .971|
| Cannabis         | 66 | 0.14| 1.64| 180| 0.23| 1.51| .009| .001| l | 0.002| .968|
| General          | 22 | 0.64| 1.14| 67 | 0.46| 1.25| −0.09| .001| l | 0.093| .761|
| Knowledge about psychoactive substances | 1.65| 6.03| 0.30| 4.79| 1.336| .483| .006***|

Note. PAS = psychoactive substances; M = non-adjusted mean; AMD = adjusted mean difference values (IG-CG); partial η² = adjusted effect size of the predictor “group.”
* p < .05. ** p < .01.
p = .000), a higher level of perceived biopsychosocial stress (U = 94,158.5, p = .000), and used more alcohol, t(262) = −5.32, p = .000, tobacco, t(228) = −3.16, p = .002, and cannabis, t(65) = −3.38, p = .001, in the last 30 days. At the same time, they had a higher personal risk perception regarding alcohol, t(365) = −2.03, p = .043, and tobacco, t(452) = −2.13, p = .033, and a higher general risk perception regarding cannabis, t(150) = −1.99, p = .049. Finally, they had better knowledge about cannabis.

**Results in the Total Sample**

*Sensitivity analyses.* The calculation of effect sizes for hierarchical data with the five dependent variables with a DE > 2 was carried out using Optimal Design V.2.0 (Raudenbush, 2011). For the 46 classrooms with an average cluster size of 15.72, 1 − β = .80, α = .05 and ρ = .11, a detectable effects size of d > .35 was calculated.

The sensitivity for non-hierarchical data was computed using the software G-Power (Faul, Erdfelder, Lang, & Buchner, 2007). Detectable effect sizes of d > .15 were found for ANCOVA with n = 723, two groups (df = 1), 10 covariates, 1 − β = .80, and α = .05. For the logistic regression analysis with odds ratio (OR) = .55 (drunkenness) and OR = .55 (traditional family setting), a power of 1 − β > .94 was calculated (two tailed), Pr(Y = 1/X = 0), H0 = 0.5 1, α = .05, n = 723, R²other X = .08, Binomial × parm π = .68.

*Substance use, risk perception, and knowledge about psychoactive substances.* Results of the multilevel regression analyses are shown in Table 2. Significant regression weights were found while controlling for covariates in the dependent variables general risk perception of tobacco use for users (B = −.647, p = .02) and knowledge about psychoactive substances (B = 1.336; p = .006). The participation in REBOUND was associated with a significant decrease in general risk perception of tobacco use for smokers but remained on a high level (4.9 on a 7-point scale) and resulted in a highly significant increase in knowledge about psychoactive substances (see Table 3 for the results of the ANCOVAs).

The adjusted mean difference (AMD) provides information about the difference between the mean values in the IG and CG (comparisons of main effects were Bonferroni-adjusted). Based on the adjusted effect sizes (partial η²) of the predictor group, effect sizes f were calculated. A significant influence of the predictor group was found regarding the T2 − T1 difference values of the DV for personal risk perception of tobacco use for users (AMD = −.85, F = 6.28, df = 1, p = .018, f = .14) and general risk perception of tobacco use (AMD = −.33, F = 5.6, df = 1, p = .018, f = .14), and cannabis use for non-users (AMD = −.54, F = 13.18, df = 1, p = .000, f = .16).

These results indicate that after participating in REBOUND, users of tobacco rated their tobacco consumption as less dangerous than tobacco users in the CG. In addition, non-user in the IG compared with the non-user in the CG showed a decrease in general risk perception of tobacco and cannabis.

**Incidence rates.** The results of the logistic regression analyses are shown in Table 4. The best model fit was found by the Hosmer–Lemeshow global model fit tests on the DV incidence of cannabis use and incidence of drunkenness. Although the best fit (Nagelkerke pseudo-R²) was found for the DV incidence of cannabis use, the contribution of the predictor group was not significant (Wald test). However, the Wald test was significant for the predictor group for the DV incidence of drunkenness. Students in the IG had a decreased risk of initiating first drunkenness compared with the CG (OR = .55; 95% confidence interval [CI] = [.32, .95]).

Using logistic regression, traditional family setting significantly predicted the incidence of drunkenness (Wald = 3.9, df = 1, OR = .55, 95% CI = [.3, .99], p = .048). The probability for initiating first drunkenness in students who live with their two biological parents is .55 times larger. All significant results in the total sample are shown in Figure 2.

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**Table 4. Logistic Regression Analyses of the Intervention Effects on the Incidence Rates of Alcohol, Tobacco, and Cannabis Use and Drunkenness Experiences.**

| Effects of the intervention on the incidence of . . . | Hosmer–Lemeshow test |  χ² statistic (df) | p  | Pseudo-R² | B  | SE | Wald | p  | OR (CI = 95%) |
|-------------------------------------------------------|-----------------------|------------------|----|-----------|----|----|------|----|--------------|
| Alcohol use                                           | 8.5 (8)               | .387             | .038 | .13 | .27 | .022 | .640 | 1.13 [67, 1.93] |
| Tobacco use                                           | 11.3 (8)              | .189             | .054 | −.02 | .32 | .000 | .954 | 1.02 [55, 1.9]  |
| Cannabis use                                          | 4.6 (8)               | .801             | .125 | .35 | .432 | .067 | .411 | 1.43 [61, 3.32] |
| Drunkenness                                           | 10.27 (8)             | .247             | .048 | −.60 | .28 | 4.53 | .033* | 0.55 [32, .95]  |

Note. The Hosmer–Lemeshow goodness-of-fit test for testing the model validity with χ² statistic. Pseudo-R² = model fit index by Nagelkerke; Wald = Wald test (with one degree of freedom) analyzed the predictive power of the predictor “group” for significance (*p < .05). SE = standard error; OR = odds ratio; CI = confidence interval.
Results in the Subgroups

Sensitivity analyses. The results of the ANCOVA and logistic regression analyses are presented in Table 5 and Figure 3 for all subgroups. Due to the formation of subgroups with smaller sample sizes, a decrease of statistical power is to be expected (Kleist, 2007). To determine the discoverable effect sizes in the subgroup analyses, sensitivity analyses (Faul, et al., 2007) were conducted. Detectable effect sizes of $d > .146$ were calculated for the subgroup of students at academic high school (ANCOVA with two groups ($df = 1$), four covariates, $1 - \beta = .80$, and $\alpha = .05$). The detectable effect sizes for students at vocational high schools were $d > .51$. For the subgroups of boys and the age group of 14- to 15-year-olds, a statistical power of $1 - \beta > .88$ was calculated (two tailed), $Pr(Y = 1 / X = 0)$, $H0 = 0.51$, $\alpha = .05$, $R^2_{other X} = .08$, Binomial $\times$ parm $\pi = .46$ and .49, for the logistic regression analyses with OR = .37 (incidence of drunkenness in boys) and OR = .44 (incidence of drunkenness among 14- to 15-year-olds).

Interactions. Regarding the IG/CG and the subgroups, the following interactions were found with regard to the study variables: gender by group for the dependent variable drunkenness incidence ($Wald = 3.99$, $df = 1$, OR = .74, 95% CI = [.54, .99], $p = .044$), school type by group for the dependent variable drunkenness incidence ($Wald = 7.97$, $df = 1$, OR = .76, 95% CI = [.63, .92], $p = .05$), 30-day alcohol use prevalence ($F = 16.31$, $df = 1$, $p = .000$), 30-day tobacco use prevalence ($F = 6.29$, $df = 1$, $p = .013$), 30 days' cannabis use prevalence ($F = 9.3$, $df = 1$, $p = .03$), relative alcohol risk perception ($F = 5.76$, $df = 1$, $p = .17$), and age group by group for the dependent variable drunkenness incidence ($Wald = 3.99$, $df = 1$, OR = .34, 95% CI = [.54, .99], $p = .46$).

Gender. A significant result in the subgroup gender was found for the incidence of drunkenness for boys ($Wald = 7.1$, $df = 1$, OR = .37, 95% CI = [.18, .77], $p = .008$). The probability for an initiation of the first drunkenness for boys in the intervention group is 0.37 times higher than in the control group.
Table 5. Results of ANOVA and Logistic Regression Analyses: Intervention effects in the Subgroups of Boys, the Age Group of 14- and 15-Year-Old, and School Types.

|                          | F  | AMD  | Partial $\eta^2$ | W  | B   | SE  | OR (CI = 95%) | df | p     |
|--------------------------|----|------|------------------|----|-----|-----|---------------|----|-------|
| Sex: Male                |    |      |                  |    |     |     |               |    |       |
| Incidence drunkenness    | 7.1| -0.99| 0.37             | 0.37[0.18, 0.77] | 1 | 0.008**|
| Age group: 14 to 15 years old |    |      |                  |    |     |     |               |    |       |
| Incidence drunkenness    | 8.1| -0.81| 0.29             | 0.44[0.25, 0.77] | 1 | 0.004***|
| School type: Academic high school |    |      |                  |    |     |     |               |    |       |
| Incidence drunkenness    | 7.1| -0.99| 0.37             | 0.37[0.18, 0.77] | 1 | 0.008**|
| 30 days’ prevalence     |    |      |                  |    |     |     |               |    |       |
| alcohol                 | 1.44| -0.99| 0.022            | 1   | 0.017*|
| cannabis                | 6.83| -2.51| 0.176            | 1   | 0.014*|
| Substance knowledge     | 12.95| 2.37 | 0.036            | 1   | 0.000**|
| School type: Vocational high school |    |      |                  |    |     |     |               |    |       |
| Relative alcohol-risk perception | 5.57| 0.46 | 0.024            | 1   | 0.024*|

Note. AMD = adjusted mean difference of the groups (IG-CG), partial $\eta^2$ = adjusted effect size of the predictor group, W = Wald test: tests the predictive power of the predictor “group” for significance (*$p < .05$; SE = standard error; OR = odds ratio; CI = 95% confidence interval; IG = intervention group; CG = control group.

* $p < .05$. ** $p < .01$.

Figure 3. Comparison of IG and CG for males, age 14 to 15 and academic high school concerning significant changes before and after the intervention.

Note. IG = intervention group; CG = control group; LTP = lifetime prevalence.

* $p < .05$. ** $p < .01$. 


School type. The highest number of significant intervention effects was found in the subgroup of academic high school students. After the course, students in the intervention group consumed significantly less alcohol (\( F = 1.44, df = 1, p = .017 \)) and less cannabis (\( F = 6.83, df = 1, p = .014 \)) in the past 30 days, and knew more about psychoactive substances (\( F = 12.95, df = 1, p = .000 \)). Participants of REBOUND in vocational high schools reported a higher relative risk perception of alcohol than the control group (\( F = 5.571, df = 1, p = .019 \)).

Age groups. The younger REBOUND participants (age group of 14 to 15 years) showed a significantly lower incidence of drunkenness was 0.44 times higher than in the control group. The probability for initiating first drunkenness was 0.44 times higher than in the control group.

Discussion

Summary of Results

The present study examined effects of the life skills and risk education program REBOUND on substance use, risk perception, and knowledge about psychoactive substances. The total sample and the subgroups gender, age, and school types were examined.

In the total sample, fewer students initiated first drunkenness compared with controls. The decreased initiation of drunkenness directly after the course can be interpreted as a first indication of risk competent dealing with alcohol and not just a change of cognitions. Similar effects were found previously in life-skills programs (Botvin, et al., 2003; Faggiano, et al., 2005; Poduska, et al., 2008).

After the course, the personal risk perception in smokers and the general tobacco and cannabis risk perception in non-users decreased, but remained on a high level. However, no increase in the incidence of tobacco or cannabis consumption was found, although the average age of onset in tobacco consumption in Germany currently is at 14.3 years (Bundeszentrale für gesundheitliche Aufklärung, 2012); this is when the course starts. This decrease in risk perception could be interpreted as an iatrogenic effect, which would need to be cared for in a program revision. The alternative view is seeing it as a desirable reduction in unrealistic high-risk perception (presumably acquired through scare tactics). Such a disproportionate risk perception may trigger a trivialization of risks when actually being confronted with the reality of drug use (see switching-risk effect; Zwick, 2005). This is particularly true for cannabis with its polarized public image. Given the political changes in cannabis politics, further research is needed to determine such effects. In providing science-based trustworthy and balanced information, REBOUND supports an autonomous and more adequate assessment of risks in this age group.

Subgroup analyses showed that male students in the intervention group were less likely to initiate first drunkenness. This indicates increased risk competence with regard to the control of alcohol. Because the risk for alcohol-related problems in males is generally increased (Lev-Ran, et al., 2013), this finding represents an important component of the effectiveness of REBOUND. The program also had a stronger influence on the consumption behavior of academic high school students (Gymnasium) compared with vocational high school students: The 30-day prevalence was reduced for both alcohol and cannabis use in this school type.

Students in academic high school after the course show increased substance knowledge, indicating better handling of objectively verifiable information. This education bias confirms findings in previous studies showing that students with stronger cognitive and linguistic capacities benefit more from prevention courses (e.g., O’Malley et al., 2006).

In vocational high school, REBOUND contributed to increasing the relative alcohol risk perception, suggesting a reduction of the self-serving bias (underestimation of one’s own vulnerability compared with others; Weinstein, 1980) and indicating an increase in critical reflection and successful risk pedagogy.

After the course, the subgroup of younger participants (14 to 15-year-olds) had a lower incidence of initiating drunkenness. This is a favorable effect considering the increased risk of a pathological development connected with early onset of alcohol consumption (Chou & Pickering, 1992; Laucht & Schmid, 2007; Lynskey, et al., 2003; Robins & Przybeck, 1985).

The results of the subgroup analyses allow for a more precise interpretation of the findings in the total sample. The increase of knowledge in the total sample predominantly originates from the participants in academic high school, and the decline in incidence of drunkenness is due to the younger and male course participants.

Methodological Strengths and Weaknesses of the Study

The methodological strengths of the study are the multilevel analyses, the propensity score matching, and the control of covariates. These strengths can counteract the disadvantages of the study design. In this first evaluation of REBOUND, only a small number of schools participated. This weakness, as well as school internal organizational issues, made only a partial randomization at the class level possible. Due to this pilot design, a spillover effect could have happened (Angelucci & Di Maro, 2015), that is, a possible exchange of the course content between IG and CG, and was not controlled for. Randomization problems are well known regarding educational settings. Due to the small sample size and the strong dropout, only small effects (0.10 < f < 0.24) could be found. More students with consumption experiences dropped out from the CG or were excluded in the matching procedure. Parts of the systematic dropout can be explained by low
compliance of those students who did not participate in the course.

Strengths of the subgroup analyses are the examination of the interactions between subgroups and intervention in relation to the dependent variables, the statistical controlling of the influence of covariates, and the Bonferroni–Holm adjustment. The sample equivalence was checked for all study variables, and intervention effects were examined only for those variables for which no differences between IG and CG were found before the course. This meant only a few criterion variables could be examined.

Conclusion and Practical Implications

There is a need for life skills programs that include substance use addressing young people in late adolescence and early adulthood (Foxcroft & Tsertsvadze, 2011; Thomas & Perera, 2006; Tobler, et al., 2000). In this phase, universal school-based programs typically are working with inhomogeneous groups with significant differences regarding resilience and risk behaviors.

Conceptually, the program is geared toward medium-(after 2 years) and long-term (over 5 years) self-regulation (Bandura, 2005). First improvements of risk competence were found concerning knowledge and initiation of drunkenness in the total sample; in subgroups, frequency of cannabis use was reduced. The negative effects on risk perception occurred with no negative effects on consumption measured after the course. REBOUND intends to stimulate a qualitative change of functions and social contexts of consumption (Franzkowiak, 2001; Koller, 2004), which has yet to be proved. Long-term effects of REBOUND as well as the long-term impact of the measured risk perception changes should be analyzed in follow-up studies. Future evaluation with a larger school sample should include program effects on life skills and resilience variables. Teacher and parent outcomes should be added.

Risk education components of the program should more intensely consider the issue of tobacco use (Faggiano, et al., 2015). First improvements of risk competence were found concerning tobacco smoking in the total sample; in subgroups, frequency of cannabis use was reduced. The negative effects on risk perception occurred with no negative effects on consumption measured after the course. REBOUND intends to stimulate a qualitative change of functions and social contexts of consumption (Franzkowiak, 2001; Koller, 2004), which has yet to be proved. Long-term effects of REBOUND as well as the long-term impact of the measured risk perception changes should be analyzed in follow-up studies. Future evaluation with a larger school sample should include program effects on life skills and resilience variables. Teacher and parent outcomes should be added.

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References

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179-211.

Angelucci, M., & Di Maro, V. (2015). Program evaluation and spillover effects (Policy Research Working Paper, No. WPS7243). Washington, DC: World Bank Group.

Bandura, A. (2005). The primacy of self-regulation in health promotion. Applied Psychology: An International Review, 54, 245-254.

Becker, M. H. (1974). The health belief model and personal health behavior. Health Education Monographs, 2, 234-508.

Botvin, G. J., Griffin, K. W., Paul, E., & Macaulay, A. P. (2003). Preventing tobacco and alcohol use among elementary school students through life skills training. Journal of Child & Adolescent Substance Abuse, 12(4), 1-17.

Brookes, S. T., Whitley, E., Peters, T. J., Mulheran, P. A., Egger, M., & Davey Smith, G. (2001). Subgroup analyses in randomised controlled trials: Quantifying the risks of false-positives and false-negatives. Health Technology Assessment (Winchester, England), 5(33), 1-56.

Bundeszentrale für gesundheitliche Aufklärung. (2012). Drogenaffinitätsstudie Jugendlicher in der Bundesrepublik Deutschland 2011. Der Konsum von Alkohol, Tabak und illegalen Drogen: aktuelle Verbreitung und Trends [Study on drug affinity of youth in the Federal Republic of Germany 2011. The consumption of alcohol, tobacco and illicit drugs: Current dissemination and trends]. Köln, Germany: Author.

Chou, S. P., & Pickering, R. P. (1992). Early onset of drinking as a risk factor for lifetime alcohol-related problems. British Journal of Addiction, 87, 1199-1204.

Cujpers, P. (2002). Effective ingredients of school-based drug prevention programs: A systematic review. Addictive Behaviors, 27, 1009-1023.

Décieux, P. J., Heinz, A., & Jacob, R. (2011). Online-Erhebungen mit EFS Survey: Ein Überblick über grundlegende Funktionen des Erhebungsprogrammes [Online surveys with EFS survey: An overview on basic functions of the survey platform]. Munich, Germany: GRIN Verlag.

Faggiano, F., Vigna-Taglianti, F., Versino, E., Zambon, A., Borraccino, A., & Lemma, P. (2005). Universal school-based prevention for illicit drug use. Cochrane Database of Systematic Reviews, 12, Article CD003020. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003020.pub3/abstract

Fahrenkrug, H. (1998). Risikokompetenz - eine neue Leitlinie für den Umgang mit “riskanten Räuschen”? [Risk Competence—A new guideline for dealing with “risky intoxication”?]. Suchtmagazin, 24(3), 23-27.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39, 175-191.

Foxcroft, D., & Tsertsvadze, A. (2011). Universal school-based prevention programs for alcohol misuse in young people. Documentation Centre on Drug Use, 5. Retrieved from http://www.drugsandalcohol.ie/15098
Franzkiwia, P. (1996). Risikokompetenz—Eine neue Leitorientierung für die primäre Suchtprävention? [Risk competence – A new guideline for primary prevention?] Neue Praxis, 25, 409-425.

Franzkiwia, P. (2001). Risikokompetenz in der Suchtprävention. Potentiale und Probleme [Risk competence in substance misuse prevention. Potentials and problems]. Prävention, 24, 102-104.

Hawks, K., & Scott, K. (2002). Prevention of psychoactive substance abuse: A selected review of what works in the area of prevention. Geneva, Switzerland: World Health Organization.

Ho, D., Imai, K., King, G., & Stuart, E. A. (2011). MatchIt: Nonparametric preprocessing for parametric causal inference. Journal of Statistical Software, 42(8), 1-28. doi:10.18637/jss.v042.i08

Holm, S. (1979). A simple sequentially rejective multiple test procedure. Scandinavian Journal of Statistics, 6, 65-70.

Jessor, R., & Jessor, S. L. (1977). Problem behavior and psychosocial development: A longitudinal study of youth. San Diego, CA: Academic Press.

Kleist, P. (2007). Vorsicht bei Subgruppenanalysen! [Caution with subgroup analyses!] Schweiz Med Forum, 7, 794-799.

Koller, G. (2004). Risikokompetente Suchtprävention: Voraussetzung und Wegbegleitung für Jugendliche, Rausch- und Risikobalance zu entwickeln [Risk competent prevention: Premise and companion for young people to develop balance concerning intoxication and risk]. AJS-Informationen, 47(2), 14-19.

Kröninger-Jungaberle, H., Nagy, E., von Heyden, M., DuBois, F., & the REBOUND Participative Development Group. (2014). REBOUND: A media-based life skills and risk education programme. Health Education Journal, 74, 705-719. doi:10.1177/0178969014557097

Kulis, S., Yabiku, S. T., Marsiglia, F. F., Nieri, T., & Crossman, A. (2008). The American Journal on Addictions, 17, 794-799.

Madden, P. A., Nelson, E. C., . . . Martin, N. G. (2003). Escalation of drug use in early-onset cannabis users vs co-twin controls. Journal of the American Medical Association, 289, 427-433.

Muthén, B. O., & Satorra, A. (1995). Complex sample data in structural equation modeling. Sociological Methodology, 25, 267-316.

Muthén, L. K., & Muthén, B. O. (1998). M Plus statistical analysis with latent variables: User’s guide. Los Angeles, CA: Author.

Poduska, J. M., Kellam, S. G., Wang, W., Brown, C. H., Ialongo, N. S., & Toynbo, P. (2008). Impact of the Good Behavior Game, a universal classroom-based behavior intervention, on young adult service use for problems with emotions, behavior, or drugs or alcohol. Drug and Alcohol Dependence, 93(Suppl. 1), S29-S44.

Raudenbush, S. W. (2011). Optimal design software for multilevel and longitudinal research (Version 3.01). Retrieved from http://hlmssoft.net/od/

Resch, F. (1999). Entwicklungspychopathologie des Kindes- und Jugendalters: Ein Lehrbuch [Developmental psychology in childhood and adolescence]. Beltz, Psychologie-Verlag-Union.

Robins, L. N., & Przybeck, T. R. (1985). Age of onset of drug use as a factor in drug and other disorders. NIDA Research Monograph, 56, 178-192.

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. Biometrika, 70(1), 41-55. doi:10.1093/biomet/70.1.41

Rothwell, P. (2005). Subgroup analysis in randomised controlled trials: Importance, indications, and interpretation. Lancet, 365, 176-186.

Silbereisen, R. K., & Reese, A. (2001). Substanzgebrauch: Illegale Drogen und Alkohol. Opladen, Germany: Leske + Budrich.

Thomas, R. E., & Perera, R. (2006). School-based programmes for preventing smoking. Documentation Centre on Drug Use, 3. Retrieved from http://www.drugsandalcohol.ie/16635/

van Etten, M. L., & Anthony, J. C. (2001). Male–female differences in transitions from first drug opportunity to first use: Searching for subgroup variation by age, race, region, and urban status. Journal of Women’s Health & Gender-Based Medicine, 10, 797-804.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. Journal of Personality and Social Psychology, 39, 806-820.

Zwick, M. M. (2005). Risk as perceived by the German public: Pervasive risks and “switching” risks. Journal of Risk Research, 8, 481-498. doi:10.1080/13669870500064150

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