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The effectiveness of a school-based intervention study on drugs - design and results

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Abstract

In the context of drug and addiction prevention at school, it is important to provide students with expertise knowledge and strengthen their personal, risk, and action competencies. Science curricula in the Federal Republic of Germany show insufficient links to the substance class of amphetamines. To follow up on successful drug prevention, an intervention study was conducted with 112 students aged 15 to 18 years at Friedrich Schiller University Jena in the fall of 2020. The effectiveness of the drug project day was tested by working through ten stations that addressed the illicit drugs amphetamine, methamphetamine, and ecstasy in a methodically varied way [1]. The paper focuses on the statistical data analysis of the pre-post questionnaire survey, which determines the students´ different types of interest in the study and the program effects. In addition, the content learning expressed in post questionnaires are evaluated using qualitative content analysis. Furthermore, results of the groups' processing methods at each station will be presented through a fully standardized observation protocol that includes criteria of collaborative aspects and documents the intervention by a trained team of observers [2,3].

Keywords: *drug prevention, acceptance study, qualitative content analysis*

1. Introduction

This research project presents the first results of the main study, in which the curricular learning unit *"drugs within a context of chemistry teaching - The substance class of amphetamines"* was conducted with 112 students. In order to conceptually as well as empirically intertwine the topic and to examine its effectiveness for teaching practice, the present research work is oriented towards several subject didactic principles. Thus, it succeeds in combining curricular innovation and development research as well as subject didactic transfer research with teaching-learning research and empirical social research. Particularly for the experimental stations (detection reactions, rapid drug tests), a linking of subject didactics and subject science (especially with the ESA-TEST GmbH from Eisenach) is profitable. In connection with the model of participatory didactic action research, three cyclical phases of development and evaluation of the new concept can be stated, which are initiated within the framework of *Learning to Teach-Lab: Science (LTL:S)* of the project *Getting it right from the beginning – Professionalization in the Jena Model of Teacher Education (PROFJL²)* [4]. Based on initial trials with teachers and students in the context of in-service training and university courses (October 2018 to August 2019), it was possible to adapt the materials to the school context. Through a pilot study in December 2019, the learning unit could be tested for the first time with two school classes (32 students) and optimized for the upcoming main study in fall 2020, in which seven school classes from Thuringia participated. The intervention study was conducted under constant framework conditions in the form of a laboratory study at the Friedrich Schiller University Jena. While questionnaires in open and closed formats were used before and after the intervention (pre-post approach), the processing of the stations in collaborative work forms (a total of 39 learning groups) could be documented by a trained team of observers.

2. Central questions

The following central questions are the focus of the research project:
(a) What short-term program effects can be ensured by the project day?
(b) How do the students evaluate the entire program and the individual stations?
(c) What content-related learning can be observed as a result of the intervention?

(d) How do the different learning groups process the individual learning stations in terms of content and method?

3. Selected results and data analysis

A total of 112 pre- and post-questionnaire data were generated. Of the students attending grades 10 and 11, 38 were male and 74 were female. A total of five cooperating schools from Thuringia participated, which show different types. Thus, 58 students were from a “Gemeinschaftsschule” (mixed school type with a special pedagogical profile, where students can acquire different qualifications), 40 from a “Gymnasium” (type of school (grades 5 to 12) in which the A-level is obtained after grade 12), and 14 from a “Regelschule” (type of school (grades 5 to 9 or 10) in which general education and pre-vocational education for a qualified occupation are pursued).

3.1 Statistical analysis of the questionnaire survey

Three constructs each were rated by students on a four-point Likert scale in both the pretest and posttest (t_0, t_1). Results include statistical analyses of means, exploratory analyses to identify group differences, and rank correlation analyses [2].

3.2 Pre-post comparisons

Results of the sign test make it clear that because of the intervention, there are no statistically significant differences in terms of *individual interest in the topic of drugs* and *situational interest in the subject matter* (recorded in the pre-test under the variable *expectations of the event*). However, students' *individual interest in the topic of drugs* is statistically significantly higher than their *individual interest in the subject of chemistry* (t_0) both before ($p = .000$, $r = .38$) and after the intervention ($p = .001$, $r = .33$, medium effect).

3.3 Explorative analyses

Female and male students differ statistically significantly in terms of *individual interest in the topic of drugs* both before ($U = 972.5$, $p = .012$, $r = .24$) and after the intervention ($U = 911$, $p = .003$, $r = .28$). Female students each showed higher *individual interest in the topic of drugs*. The largest statistically significant difference with respect to gender is the variable *situational interest in the subject matter* (t_1) (Fig. 1, left). Female students (Md = 3.50) assess the implementation of the stations more positively than male participants (Md = 3.00, exact Mann-Whitney U test: $U = 757.5$, $p = .000$, $r = .34$). The effect size here corresponds to a medium effect. Results of the Kruskal-Wallis test demonstrate that only *situational interest in the subject matter* is affected by school types ($\chi^2 = 9.953$, $p = .007$, Fig. 1, right). The post-hoc test shows that students from the “Gymnasium” differ statistically significantly from subjects from the “Gemeinschaftsschule” with a medium effect ($z = -2.892$, $p = .011$, $r = .30$). While students from the “Gemeinschaftsschule” and the “Regelschule” rate all variables of the pre- and post-questionnaire equally, students from “Gymnasium” (Md = 3.50) rate especially the implementation of the intervention significantly better.

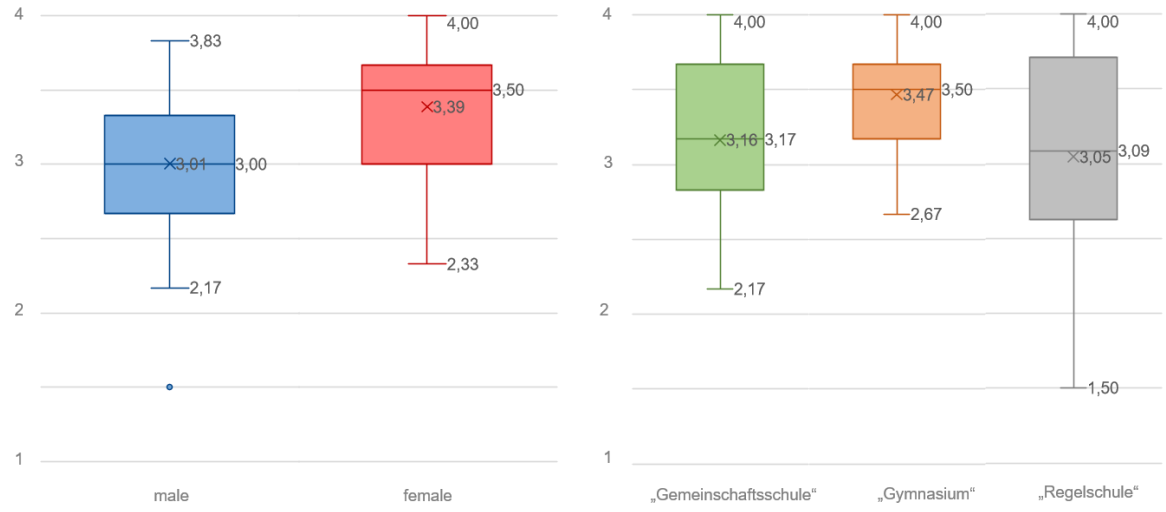

Fig. 1. Grouped box plots of the variable *situational interest in the subject matter* (t_1) as a function of gender (left) and school type (right)

3.4 Spearman Rank Correlation Analysis

Applying Spearman Rank correlation analysis, ten statistically significant correlations can be determined. Among others, it shows *that individual interest in the topic of drugs* after the intervention correlates positively with *situational interest in the subject matter* (r_s = .51, p = .000, n = 108). Students who show higher post-intervention interest in the drug issue also rate the implementation of the stations more positively. Content knowledge growth correlates positively with *situational interest in the subject matter* as a result of the intervention (r_s = .31, p = .002, n = 100). Consequently, students who perceive the completion of the stations more positively also rate the acquired knowledge higher.

3.5 Evaluation of the free expressions of the posttest - inductive category formation

In addition to the program effects shown, the open-ended responses regarding the five topic areas (Table 1) could be evaluated using qualitative content analysis, which examines content learning due to the intervention [3]. Through the intercoder check, the preliminary category system could be revised and ultimately 1263 codes could be generated. In addition to content dimensions, argumentative utterances and subjective conclusions could be recorded in parallel in four of the five main categories. These include, among others, the subjectively assessed degree of difficulty of chemical structural formulas, social-ethical attitudes towards the use of drugs, or the critical handling of rapid drug tests.

Table 1. Main and subcategories of the "content learning growth" category system of the post-questionnaire (including absolute frequencies).

Molecular structures (184)	*structural similarity of the three compounds* ***(85)*** *components* ***(67)*** *differentiated opinion* ***(24)*** *other* ***(8)***
History (239)	*areas of application* ***(126)*** *actors* ***(35)*** *other* ***(78)***
Production (67)	*sequence of several steps* ***(29)*** *differentiated opinion* ***(25)*** *illegal production (drugs, drug laboratories)* ***(13)***
Effects (337)	*adverse/negative effects* ***(140)*** *desired/positive effects* ***(90)*** *differentiated opinion* ***(97)*** *other aspects* ***(10)***
Detection options (277)	*handling of rapid drug tests* ***(73)*** *inaccuracy of rapid drug tests* ***(111)*** *content-related aspects* ***(52)*** *general* ***(41)***

3.6 Evaluation of the observation data

By documenting the intervention with a trained team of observers, 270 structured observation protocols were generated. A total of 39 learning groups participated in the drug intervention study. Learning groups were able to complete between five and eight mandatory stations during the intervention period. For each learning group, sum parameters of the twelve criteria were calculated for each documented observation protocol. This means that the codes of the four main criteria (work behavior, communication, social behavior, handling of learning materials) were added up and determined station by station. In the first step, the learning groups were typified with regard to basic collaborative activities (work and social behavior) (Fig. 2).

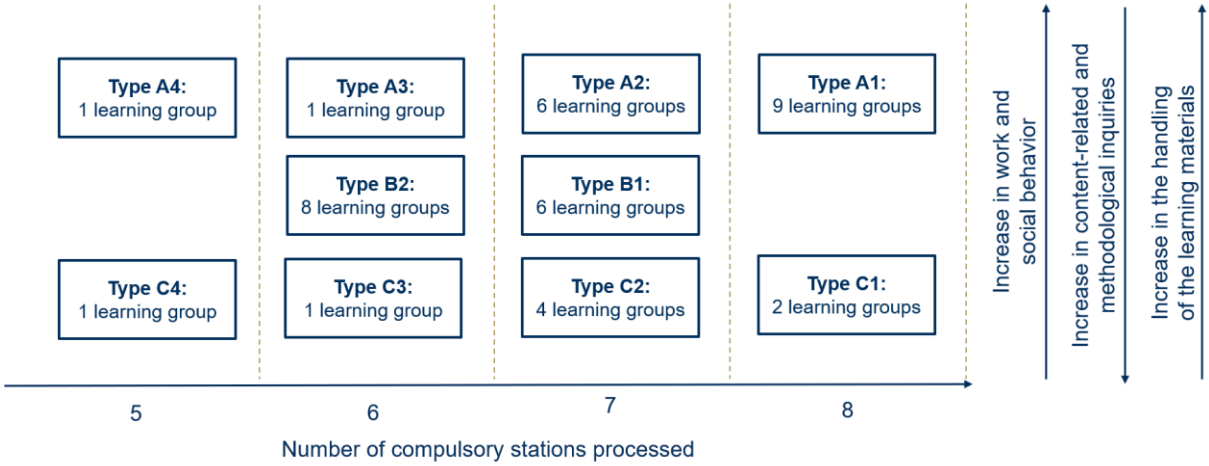

Fig. 2. Typification of the learning groups involved and trends of basic and process-related activities

It turns out that 17 learning groups (type A) show very positive working and social behavior when working through the stations, rarely lose focus, and work continuously in a goal-oriented manner. Here, very high sum parameters and very high average values for the work and social behavior are found. In a total of 14 learning groups, a high level of working and social behavior with occasional weaknesses in working and/or social behavior can be observed (type B). The majority of these learning groups show an imbalance of working and social behavior. Eight learning groups could be assigned to the groups with worse working and social behavior (type C). In these groups, numerous extraneous activities were identified, and, in comparison, a significantly more unorganized and unstructured processing of the stations was observed. A clear tendency emerges in the learning groups consisting only of female students and high school test subjects. Here, a significantly higher level of work and social behavior can be identified when working through the stations. Male and mixed learning groups show lower working and social behavior. The higher the working and social behavior within the learning groups, the fewer questions are asked about content and methods and the more targeted the handling of the learning materials are observed, so that increased problem-solving skills can be identified here.

4. Summary and outlook

The data analysis shows that students are interested in the topic of drugs and the implementation of the stations, which provides initial indications of an acceptance-oriented learning arrangement. The triangulation of different survey instruments lead to similar results and show that especially the experimental and creative stations generate a high learning attractiveness and positive resonance. In addition, effects on a differentiated, content-related learning growth can be determined. In particular, the evaluation of the free answers by means of qualitative content analysis in the posttest results in an extensive knowledge network on the detection possibilities and the effects of amphetamines. The fact that the learning subject seems to be attractive especially for the female students supports the potential of the learning stations for teaching scientific contents. The analysis of the observation protocols also supports the use of the learning set in school practice, in which the majority of the learning groups show a committed willingness to work through the stations and learn new subject matter. The long-term goal is to take the materials, which have now been positively evaluated, to schools and multipliers and to disseminate them more through cooperation.

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