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Inclusive Biology Education – How Do Pre-Service Teachers Think about Inclusion?

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Abstract

German school law guarantees barrier-free and equal access to biology education for all students. However, there are still some obstacles for students with special needs, e.g. during experiments or field trips. This results in our research questions: a) How do biology pre-service teachers rate different inclusive settings? b) Do their attitudes and self-efficacy influence their ratings? c) Which reasons do they give for and against inclusion? Positive attitudes can be predictors for the implementation of inclusive structures at school [2]. Self-efficacy beliefs are fundamental for education and teaching [5]. Self-efficacy describes personal judgement, of how well a person can execute courses of action that are required to cope with prospective situations [1]. Therefore, we expected attitudes and self-efficacy to be positive predictors for pre-service teachers` ratings of inclusive settings. Our sample consisted of 119 pre-service biology teachers (M_{age} = 20.5 years; n_{female} = 95). We confronted participants with four vignettes and asked them to rate each setting with ten bipolar adjectives, e.g. positive – negative [6]. We applied a self-report questionnaire on attitudes and self-efficacy towards inclusive schooling [2]. Findings show that pre-service teachers rated the four vignettes differently. Most positively, they rated a child with a learning disability, least positively a student with multiple disabilities. Overall, regression analyses revealed the significant influence of attitudes and self-efficacy in three of four settings. However, in most regression models only attitudes towards the arrangement of inclusive lessons became a significant predictor. At first glance, findings do not support the importance of self-efficacy beliefs. Because our pre-service teachers lack real teaching experience, they might not yet have developed realistic self-efficacy beliefs.

Keywords: *biology education, special needs, inclusion, attitudes, self-efficacy*

1. Introduction

Following the United Nations, “States Parties shall ensure an inclusive education system at all levels” [9]. In Germany, the inclusion of students with disabilities into regular schools is an important issue. Therefore, German school law has been adapted. In Lower Saxony, now it guarantees barrier-free and equal access to education for all students [3]. However, due to the former separated and exclusive school system, there are still some obstacles for students with special needs. For instance in Bremen, the principal of a high school has sued against the introduction of inclusive classes. She argued that there is still a lack of equipment and staff to ensure successful inclusion. Concerning biology education, there might also be subject-related obstacles. For instance, while experimenting or during field trips. Furthermore, biology classes often take place in specific laboratory classrooms, which might cause problems. Therefore, it seems necessary, to have a closer look at inclusion from the perspective of biology education. Following [8] “there is widespread acceptance that teacher training institutions must ensure that new teachers are trained to teach effectively in classrooms where there are students with a variety of learning needs”. Since we also see the potential pre-service teachers have to implement inclusive attitudes in schools, we focused on aspiring biology teachers. Predominantly three research questions have guided our research:

a) How do pre-service biology teachers rate different inclusive settings?
b) Do their attitudes and self-efficacy influence their ratings?
c) Which reasons do pre-service biology teachers give for and against inclusion?

2. Theoretical Background

Depending on students’ specific disability, the demands on the school environment and on biology classes might differ. Seifried [6] developed vignettes for four specific inclusive settings. Each setting described a student with its specific special needs. Teachers were asked to rate each setting. A significant difference in the ratings of these settings was found [6]. The assessment depended on the type and severity of disability. Most positive rated was the inclusion of a gifted student with behavioural

problems. Lowest rated, was the inclusion of a child with multiple disabilities [6]. In our study, we expected a similar rating of these four vignettes in the context of biology classes.
Attitudes are important concepts in classroom practices. They can drive classroom actions and a person's individual actions [4]. Positive attitudes can be predictors for the implementation of inclusive structures at school [2]. Self-efficacy beliefs are fundamental for education and teaching [5]. Self-efficacy describes the personal judgement of how well a person can execute courses of action that are required to deal with prospective situations [1]. Former experiences of success or failure influence a person's self-efficacy. In-service teacher's attitudes and efficacy significantly predict participant's intentions to include learners with disabilities [7]. Therefore, we expected attitudes and self-efficacy to be positive predictors for pre-service teachers` ratings of inclusive settings.
Our last qualitative research question focused on pre-service teachers subject-related concerns to include learners with disabilities in their biology classrooms.

3. Methods

We applied a self-report questionnaire to the participants. The evaluation took place at the University of Vechta. There was only one measurement. Our sample consisted of 119 pre-service biology teachers (M_{age} = 20.5), 95 of them being female. In our questionnaire, we confronted the participants with four vignettes, which were adapted [6]. All vignettes related to biology classes. Pre-service teachers rated each setting with ten bipolar adjectives, e.g. ranging from positive (= 3) to negative (= -3). A 7-point Likert scale was applied. Participants also gave reasons for their ratings. The first vignette characterized a gifted student with behavioural problems. This child quickly felt under-challenged and reacted with impatience and aggression towards classmates and teachers. The second setting described a student with a learning disability. This child had problems with reading and calculating. Therefore, it needed additional explanations and more time. The third vignette characterized a visually impaired child. It was not able to read the normal typeface and learnt braille. This student needed additional descriptions and had orientation problems, even with everyday actions. The last setting was about a child with multiple disabilities. This child communicated via face and body language, needed a wheelchair and was fed artificially. Cronbach's alphas ranged for these vignettes from α = .867 (child with learning disability) to α = .934 (visually impaired student).
We measured attitudes and self-efficacy with an adapted version of the KIESEL questionnaire [2]. Each construct consisted of three subscales with four items. A 5-point Likert scale was applied from "I do not agree" (= 0) to "I completely agree" (= 5). In detail, we looked at attitudes with regard to a) the arrangement of inclusive lessons (α = .770), b) effects of inclusive lessons (α = .727) and c) the influence of student behaviour on inclusive lessons (α = .690). The subscales on self-efficacy focused on self-efficacy regarding a) the arrangement of inclusive lessons (α = .765), b) dealing with classroom disruptions (α = .650) and c) the collaboration with parents (α = .651).

4. Findings

One-way repeated-measures ANOVA (four levels) showed a significant difference in the ratings of the four settings ($F(2.7, 308.0) = 8.98$, $p < .001$). The child with learning disability (M = 0.66, SD = 0.94) and the visually impaired student (M = 0.39, SD = 1.2) were rated significantly more positive than the student was with multiple disability (M = 0.01, SD = 1.25).
A multiple regression analysis was carried out for each setting. Predictors were the subscales on attitudes and self-efficacy. Overall, regression analyses revealed a significant effect for three settings. For instance, the regression became significant for the vignette "learning disability" (R^2 = .28, $F(6, 108) = 6.95$, $p < .001$). However, only the subscale on attitudes towards the arrangement of inclusive lessons was a significant predictor (β =.33, p = .024). In the case of the student with multiple disabilities, we also found a significant effect (R^2 =.26, $F(6, 108) = 6.15$, $p < .001$). The subscale on attitudes towards the effects of inclusive lessons appeared to be significant (β = .28, p = .013). Subscales on pre-service teachers' self-efficacy did not significantly contribute to the ratings.
Regarding inclusive schooling in biology classes, pre-service teachers expressed several concerns. Overall, they mentioned 18 issues that might become a problem specifically for inclusion in biology classes. However, they also gave 24 reasons why biology education is particularly suitable for inclusion (e.g. subject is concrete, vivid, arouses interest). Negative comments referred to experiments that might be too dangerous. One participant even gave into consideration the issue that the teacher should be able to pay attention to all students during experiments.

5. Discussion

Findings indicate that pre-service teachers differentiate between inclusive settings. It makes a difference to them, what kind and severity of disability students in their biology classes have. However, the sequence of ratings was different from the findings of Seifried [6]. One explanation might be that in our study we asked aspiring biology teachers. Biology lessons place different demands on the students (e.g. during experiments). Furthermore, most pre-service teachers might lack real teaching experience. However, findings show that it is worth taking into account different forms of disabilities in research. Students' specific special needs make a difference for educational settings (e.g. biology education). Furthermore, biology teachers have to meet the demands of individual students at school.

As we had expected, attitudes can be predictors for pre-service teachers' ratings of settings. In particular, attitudes with regard to the arrangement of inclusive settings became significant. Pre-service teachers who believe that biology lessons can be made inclusive to all children show significantly more positive ratings. In our last setting (multiple disability), attitudes towards the effects of inclusive lessons became significant. Therefore, a differentiated look at attitudes might be of benefit as well. However, pre-service teachers' self-efficacy did not significantly contribute to our regression models. Since pre-service teachers lack real teaching experiences they might not yet have developed a realistic self-efficacy. Here, it would be interesting to follow the progression of their self-efficacy during university studies and in their first years at school. Specific trainings could support them with teaching methods to meet the diversity of students and develop adequate self-efficacy.

Overall, only few biology specific reasons for or against inclusion were identified. Depending on the setting, reasons differed in quantity and quality. We appreciate that pre-service teachers emphasized reasons for the inclusion of children with special needs. They argued that biology is a vivid, illustrative and concrete subject. However, possible dangers, e.g. during experiments, were mentioned, as well.

Finally, we are convinced, that politics and schools must work together to enable barrier-free and equal access to the German education system. Together, they can create a framework to enable inclusion. However, biology teachers need additional support (e.g. teacher trainings). Together, we can contribute to successful and meaningful inclusion in biology classes.

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