FURTHERING FOREST EDUCATION – A CASE STUDY FROM GERMANY

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Abstract

This study analyses the implementation of forest education in 13 German federal states in combination with the number of applicants for a vocational education in forestry, as well as the number of students at the faculties of forestry in Germany. Obtained results show that establishing the basics of forest didactics and taking into account educational topics beside the classical knowledge of woodland species, furthers the interest in forests and forest professions in general. The number of students in the university can be considered to be a suitable indicator for a good establishment of forest didactics and a general interest in forests, while the number of applicants in vocational education can be considered to be an indicator for a holistic and sustainable approach to forest education, according to this study.

Key words: forest didactics, forest pedagogics, study motivation.

Introduction

Choosing a profession is an important step in the lives of adolescents worldwide. Studies show that personal interests and inclinations play a major role in choosing a certain vocational path (Akosah-Twumasi et al. 2018). While parental and peer influence both play an essential role in finding a decision for the question 'what do I want to do for a living?', education offers an opportunity to explore and develop interests outside the family surroundings. In Germany, professions with a focus on nature and natural sciences, in combination with a technical orientation, have a traditionally low number of students applying for an apprenticeship or academic education, compared with other vocations (Barman 1999; Bertels and Bolte 2009, 2014; Elster 2009; Taskinen 2010; Frank and Niethammer 2012; Haucke and Parchmann 2012). Studies have come to the conclusion that during their primary and secondary education many students garner negative impressions related to these professions, which result in a low interest in the corresponding vocations.

To further these vocational educations, a positive perception in the minds of pupils needs to be fostered. This means, students have to experience motivating lessons and learning settings during their time at school (Bolte 2004, Bertels and Bolte 2014) to develop a positive concept of a profession for themselves (Taskinen

2010, Bertels and Bolte 2014). During the consultations of the Global Forest Education project of the Food and Agriculture Organisation of the United Nations, the question arose at which age and to what extent forest education should be integrated into the curricula (FAO 2021). To make it short: when forest-related education is well-implemented and taught at school, using good and motivating concepts, the number of students applying for an apprenticeship should be comparatively high.

The study was conducted in regard to the German vocational and academic education system for forestry professions. Due to this, we shall have a brief introduction to the local education system: After four years of elementary schooling, German students perform/visit one form of secondary school – *Hauptschule*, *Realschule* or *Gymnasium*. The latter is especially designed to prepare for an academic education after completing the final exams with the *Abitur*, the certificate for higher education entrance qualification (Dahm and Kerst 2019). For this type of school, a student typically needs good marks (2/B or better[1]) in the relevant subjects of mathematics, German and *Sachunterricht* – a subject that is a combination of local history, geography and biology – in elementary school. Most students (90 %) going for a forest-related vocational education, have attended the *Real-* or *Hauptschule*. The *Hauptschule* is considered to be for the less able students, graduating in grade 9, while at the *Realschule* the final exams are one year later. Both of them prepare for a vocational education. The curricula of these two are mostly very similar to each other, while at the *Gymnasium* these are set to prepare students for

an academic education.

In Germany, each of the 16 federal states organizes education autonomously. Some states have forest education as mandatory set of ecosystems, while in others, teachers can choose between forests, meadows, lake, rivers, the sea, etc. Furthermore, even after 30 years of re-unified Germany, there are still cultural differences between the former West and East Germany (Arnhold 2009, Hugendick and Seuber 2019).

Forestry and forest ecosystems have a long-standing history and tradition in German education (Hepper 2017), so this can be considered to be a very well and thoroughly covered subject. This is directly linked to the historical and cultural significance of forests in Germany since the late 19th century (Wilson 2012). Typically this means that students learn, over an extended length of time, how to identify forest plants and trees, as well as tracks of woodland animals. A major focus lies in assessing the closeness to nature of forest ecosystems in secondary schools, while in elementary school students learn to identify typical trees and plants found in the local forest.

This study aims to identify the best practices of primary and secondary forest education from a German point of view. Data comes from 13 large federal states. Due to the very small number of students completing their forest-related exams, the city states of Hamburg, Bremen and Berlin were excluded from this study.

Methods

The study was conducted using a combination of grounded theory and qualitative content analysis. Following the concept of qualitative research to gather and assess

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[1] 1 = A = very good; 2 = B = good; 3 = C = satisfactory; 4 = D = pass; 5 = E = with deficits (fail mark); 6 = F = not sufficient (fail mark).

the data generated, grounded theory can be considered to be a suitable approach for working on research questions, with little or no research having been conducted before on this subject (Strauss and Corbin 1994, Tolhurst 2012). For this, a continuous exchange between gathering, analyzing and evaluating data is necessary. Due to the small set of data, the method of the case study can be considered to be a suitable approach as well (Langner 2011).

First, the forest/biology-related curricula of the 13 German states were systematically analyzed (Mayring 2010) regarding the content and extent of forest ecosystems and forestry. This was done without reading any further publications on the subject (Glaser 1965, Tolhurst 2012, Charmaz 2014). The curricula were categorized into:

- school years, where forest ecosystems/forest-related education is an integral and important part of the curriculum (being mentioned as the sole ecosystem to be taught);

- school years, where forest ecosystems/forest-related education is an elective/possible topic in the curriculum (being mentioned as one of many options or the curricula ask for local ecosystems in general);

- school years, where forest ecosystems/forest-related education is not part of the curriculum (no local ecosystem, etc., in the curricula).

After assessing the curricula, two federal states, Lower Saxony and Mecklenburg-Vorpommern, were chosen and compared regarding the number of students applying for a forest worker education in comparison to the total number of students who had completed their secondary education in the respective year. In Mecklenburg, forest ecosystems are the focus in classes 1 to 6, while in Lower Saxony, it is only one of the many possible ecosystem covered. In both states this habitat has the same importance for the A-level courses[2] in biology.

After this, first hypothesis was generated and tested against new data from other federal states. Since that reforming the hypothesis was always made after getting new data. This was repeated until a constant/stable pattern was identified (Glaser and Strauss 2010). The approach is more inductive, following Glaser's pragmatism and thorough analysis (Strübing 2002, Kelle 2005).

After curricula analysis, similar kind of approach was done for analyzing students who had passed the necessary examination for entrance to a university. The data on the number of students, who had completed their secondary school education each year in the respective federal state, are available from the Federal Statistical Office of Germany. The data regarding the number of students choosing a forestry-related vocational profession covers a time span of three years (2018–2020) and was thankfully provided by the state forest education agencies of the different provinces. The numbers regarding the university students were provided by the faculties of forestry at the various universities, which was greatly appreciated.

Regarding the students applying for a vocational education, first the percentage of the annual applicants in regard of the total number of students completing their school education was calculated for each state. The same was done for those who pursued an academic education in forestry and forest sciences. After calculating

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[2] The English term A-level is used for better understanding for international readers. In Germany, students choose a A-level course where they will have the examination or write a minor thesis paper.

the standard error, the states were categorized into four clusters. For data analysis, the cluster analysis was used. The ideal number of clusters (k-means) was 4, using the metric variables of interest (percentage of students applying for a vocational forest education of enrolling in an academic education in forestry and forest sciences) in academic and vocational education (Milligan and Cooper 1985, Tuma et al. 2009, Zenina and Borisov 2013). Cluster 4 was formed out of those states, where students had an average interest in a forestry related education. Cluster 3 consisted out of states, where the students had a higher than average interest in a vocational forestry education, compared to the average. Cluster 2 consisted out of states, where the students had a higher than average interest in an academic forestry education, while cluster 1 consisted out of states, where the students had a higher than average in vocational as well as academic forestry educations.

With forestry universities, we have the trouble that no data was available on those applying for an academic education. Some universities normally choose their students based on the *nummerus clausus*, while others had no admission requirements at all during the time of observation. With a mean NC of 2.1 to 3.0 for these universities (numbers provided by the universities), compared to an average grade of 2.1 to 2.6 in the federal states in the time span observed (KMK 2021), there was a similar chance for students from every state.

Results

Results of clustering federal states in terms of percentages of forest-related students and implementation of forest-related education are shown in Table 1. The first cluster consists of only one state Mecklenburg-Vorpommern with 2.46 % of the students applying for forest-related education (mean = 0.56 %, SD = 0.6 %). Here the percentage of students having an interest in pursuing a vocational education in forestry is nearly five times as high, as the German average. This observation continues in academic education, with this federal state again having a higher number than average, after calculating the mean and standard error.

Table 1. Results of the research with the federal states sorted in alphabetical order.

Provinces	Percentage of applicants in vocational education	Percentage of students in bachelor of science in forestry/forest sciences	Forestry/forest ecology a major subject in classes	Forestry/forest ecology a possible topic/subject
Cluster 1: provinces with a high interest in vocational and academic forestry education				
Mecklenburg-Vorpommern*	2.46 %	0.46 %	1, 2, 3, 4, A-lvl*.	5, 6
Cluster 2: provinces with a high interest in academic forestry education				
Baden-Württemberg	0.28 %	0.38 %		1, 2, 3, 4, 5, 6, A-lvl.
Bavaria	0,19	0.45 %		1, 2, 3, 4, 5, 6, 7, 8, 10, A-lvl.
Brandenburg*	0.29 %	0.44 %	4	1, 2, 3, 5, 6, 7, 8

Provinces	Percentage of applicants in vocational education	Percentage of students in bachelor of science in forestry/forest sciences	Forestry/forest ecology a major subject in classes	Forestry/forest ecology a possible topic/subject
Cluster 3: provinces with a higher than average interest in vocational forestry education				
Rhineland-Palatinate	0.73 %	0.1 %	A-lvl.	1, 2, 3, 4, 5, 6, 7, 8
Saxony-Anhalt*	0.94 %	0.13 %	4, 9	1, 2, 3, 5, 6, 10, A-lvl.
Cluster 4: provinces with an average interest in vocational and academic forestry education				
Hessen	0.51 %	0.09 %		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, A-lvl.
Lower Saxony	0.25 %	0.16 %	A-lvl.	1, 2, 3, 4, 5, 6, 7
North Rhine-Westphalia	0.11 %	0.14 %		1, 2, 3, 4, 5, 6, 7, A-lvl.
Saarland	0.49 %	0.13 %	8, A-lvl.	1, 2, 3, 4, 5, 6, 10
Saxony*	0.38 %	0.1 %	4, 6	5, 7, A-lvl.
Schleswig-Holstein	0.24 %	0.09 %		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, A-lvl.
Thuringia*	0.56 %	0.17 %	1, 2, 3, 4	7, 8, 9, 10

Note: Highlighted in bold and darker grey are those countries which stand out with particular high results. States with an asterisk * are from Eastern Germany.

With cluster 2, including federal states Baden-Württemberg, Bavaria and Brandenburg, similar results (0.38–0.46 % of all students completing their A-levels) were visible. Again, no state could be identified in having a significant low number of students applying for forestry programs in university (ø 0.14 % SD = 0.15 %).

In cluster 3, we find the states Rhineland-Palatinate and Saxony-Anhalt. These two had a higher than average number of students, applying for a vocational education in forestry, but only an average number of students applying for an academic education in forest sciences or forestry.

Hessen, Lower Saxony, North Rhine-Westphalia, Saarland, Saxony, Schleswig-Holstein and Thuringia make up the average cluster in all regards considering forestry education. In all German provinces, we find very similar topics regarding the content of forest related education

(Table 2).

In Mecklenburg-Vorpommern, forest education does not solely focus on the classical forest-related topics, but integrates healthy nutrition with forest plants, fruits and venison, orientation with a map in the forest, the health benefits of going to a forest, etc., as well (Wald-MV 2021). This is the only federal state, where this is done at the moment.

Taking these results into account, Mecklenburg-Vorpommern can be considered to be the state, where forest related education is the most effective in furthering interest in the professions related to this ecosystem. Considering the newly formed curricula, it is one of the two federal states, where relevant content is implemented as the major living environment for educational purposes in elementary school, and as an elective topic in grades 5 and 6. On first glance, this is very similar

Table 2. Results of the content analysis of the curricula.

Provinces	Topics covered in the curricula
Typical topics in all provinces	• species of trees and bushes in the forest • forest ecosystems (deciduous and coniferous), especially alluvial forests • forest layers • typical game animals and wildlife • early blossoming plants • life in the forest soil • forestry professions • forestry
Mecklen-burg-Vorpom-mern	Additionally: • reading maps and orientation • cooking with forest products like edible plants, etc. • forests and health • sounds and music in the forest

to the situation in Thuringia. Nevertheless, the results are quite different, with Thuringian students only having an average interest in becoming a forest worker or studying forest sciences, etc.

Discussion

First and foremost, successful forest-related education needs to go beyond teaching about trees, forest plants and animals. It needs to teach the skills to integrate the forest into the daily life. Being able to read maps, learn what plants are edible and what dishes to make out of them, encourage sports and other activities in the forest, should be considered to be an integral part for any forest curriculum.

What might as well make a difference is the situation, that in Mecklenburg-Vorpommern, forest-related education ends after grade 6 and only continues in A-level courses. Integration in grades 7–10, like in Thuringia and other federal states, apparently does not encourage further interest in this professional field.

When we take the number of students into account, three more federal states have a significantly higher than average

number of students in forestry bachelor programs, compared to the rest. Even though Bavaria could have a similar percentage of applicants for a vocational education as Mecklenburg-Vorpommern, this seems to be unlikely, due to the little information received during the gathering of data for this study.

While researching possible reasons for the above average number of students in forestry related bachelor of sciences courses, Brandenburg, Bavaria and Baden-Württemberg had one aspect in common, that the other states lacked: all of them have contributed major publications on forest pedagogics (Bolay and Reichle 2016, StMELF 2017, Brucker 2020), similar to the material in Mecklenburg-Vorpommern for elementary schools.

Regarding the motivation in writing a publication, very little research has been conducted so far. Key motivations for experts to publish a textbook are the considerations that such a publication would benefit learners and, most importantly, that they have perceived a gap, which needs to be filled (Collins and Stone 2019). What these publications do is fulfil the basic aspects needed for the implementation for a didactic – this means, these states have

moved from forest pedagogics to the formation of a local forest didactic. In the publication we find aspects of furthering the planning, analyzing and conducting forest-related lessons, they describe the history of forest education, justify and reflect forest pedagogics, as well as giving examples of tried and tested concepts for projects and lessons – all of these are the foundation for forming a didactics for any given subject at school (Klafki 1963, Fuchs and Siller 2007, Tenberg 2017). Compared to Mecklenburg-Vorpommern, the approaches found in the publications still focus on classical forest topics.

When it comes to publications, the two provinces of Rhineland-Palatinate and Saxony-Anhalt, both of them being part of the cluster 3, with a slightly elevated number of students applying for a vocational education in forestry, we find a similar situation. Rhineland-Palatinate offers a 'forest box', a set of material, which can be used by schools and kindergartens for free. This is akin to the approaches for forest-related didactics. Saxony-Anhalt, on the other hand, was the very first province of Germany, which educated forest pedagogues following the standards of the state certificate. This might be an indicator for a well and thoroughly established forest education, which leads to the higher interest in forestry professions.

It could be assumed, that we have differences in the local perception or the public image of forest related professions in Germany. It might even be possible, that provinces with a high percentage of forests have a higher number of students interested in an education in this field. As for the first aspect, the existing studies do not show any differences between the provinces (Bethmann and Wurster 2016). Generally speaking, forest professions apparently have a similar public percep-

tion regarding their image all over Germany. This can be considered to be due to the forest being an important cultural aspect and part of the national identity for several generations (Wilson 2012). As for the second aspect, Mecklenburg-Vorpommern is the state with the third smallest percentage of forested area, with Hessen and Saarland being among the three provinces with the highest forest coverage (State Office of Statistics 2021). So these two possibilities can be ruled out.

Considering the results, establishing a local forest didactics does have an influence on the choice of the subject studied at a university, but apparently not on the choice of vocational education. This might be due to the different motivations for studying and going for an apprenticeship. The latter being influenced by monetary inclinations, while university education has a more motivational and interest-based foundation. To identify the general interest in forests, forest-related issues, etc., the number of university students can be considered to be a good indicator.

When we want to identify excellent approaches, we should take vocational choices into consideration, as well. The lack of economical aspects in forest education is an aspect, which is rarely addressed by teachers but is desired by forest administrations (Hepper 2016).

Conclusions

When we want to develop an interest in forests, we need to implement forest-related content in grades 1 to 6. Apparently lessons in grades 7 to 10 have no beneficial effect. For this, it is necessary to not only address typical forest education topics, like knowledge on forest wildlife, but also on the use of non-timber forest prod-

ucts as food, organizing outdoor activities in the woods, etc.

Furthermore, establishing a local forest didactics, which examines and establishes methodological approaches, regularly evaluates the curricula, and creates lessons, helps to increase the interest in pursuing an academic education in forest sciences and forestry.

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