

Significance Given to Wild and Medicinal Plants in Biology Lessons – A Teacher Survey

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ABSTRACT

This study represents a teacher survey concerning the significance of wild and medicinal plants in biology lessons. 57 teachers of different school types were interrogated in Siegen (Germany). We found out that wild plants usually have a small role in biology lessons and that this significance is even lower for medicinal plants and home remedies. However there are significant differences concerning the importance these topics have today and the importance they should have according to teachers' opinion. Differences depending on the school form could be detected for medicinal plants and home remedies, but were minimal for wild plants.

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Introduction

In Germany, biology lessons and nature studies assumed the taxonomic approach (Berck 2001) for many years until the end of the sixties. Hereby the main aim was to convey knowledge of the species which took place, not least, because of the practical aspects and because it could make a contribution to a child's general knowledge. Schools maintained this approach even after biology assumed further important content. During the 1970s subjects which involved conveying knowledge of the species almost completely disappeared from schools. According to Berck (2001), an increased awareness of nature and environmental protection which occurred from the mid eighties onwards, once again enabled greater emphasis on knowledge of the species in biology lessons and it is from this from which the key question of this article derives: What significance do wild and medicinal plants as well as home remedies (mainly plant based) have in biology lessons today in primary level and secondary level I? Whereas focus used to be on the practical aspect, particularly when wild plants were used as food or for healing purposes, there are today further reasons for developing knowledge of the species in biology lessons. Berck (2001) sums up, with reference to Mayer and Horn (1993), the most important reasons:

- Knowledge of the species can be an intellectual, emotional and aesthetic enrichment in life and, with this, inspire meaningful leisure activities.
- Knowledge of the species improves: (1) our understanding of our surrounding nature, (2) our understanding of biological subjects as well as (3) our understanding of nature

and environmental protection related topics. This, in turn, can encourage a willingness to be environmentally friendly.

- Knowledge of the species helps us cope with our lives from a practical viewpoint.

Besides these considerations, the curricula of primary and secondary schools also offer opportunity to incorporate subjects which relate to both wild and medicinal plants as well as (plant based) home remedies. There are, however, differences here depending on the school form.

This paper represents an investigation derived from the above considerations on the significance of wild and medicinal plants as well as home remedies in biology lessons and is based on a teacher survey.

Theoretical Background

Nature conservation associations and environmental organisations often criticise school pupils' poor *knowledge of the species*. Children are clearly unaware of the "basics of the species" (Bosch 2000) and this is the case not only amongst primary school pupils (Hollstein 2002), but also in secondary level I, particularly in classes 5 and 6 (Jäkel & Schaer 2004). Pupils are often even unable to name the simplest, most common species. With regards to secondary level I, this applies to both the *Hauptschule* (lower level secondary school) as well as the *Gymnasium* (advanced level secondary school leading to further education/university entrance) (Moßner 1995). The fact that children who grow up in cities have an even poorer knowledge of the species than children who grow up in the countryside (Bosch 2000), only worsens matters. This inevitably arises from pupils' realms of experience which are today restricted even further by technical media (e.g., PC,

television and Playstation). In this context, Bosch (2000) also criticises the deadline pressure faced by pupils today leaving them little time to discover nature or simply play outdoors in fields or parks. Bosch (2000) gives a further reason for the lack of knowledge of the species as being that children do not learn this from their parents which makes it even more important that this is taught in biology lessons in schools. This should, however, not be regarded as the focus of the lessons but, more so, an essential element of lessons (Zucchi 2007). As part of a schoolbook survey, Blessing (2007) established that, between 1950 and 2004, the number of species referred to in the books decreased by more than 50. In other words, the basis for learning about plant species was strongly reduced. A further basis for learning about the species is how they are valued by pupils as a correlation exists between how much a pupil knows about the species and how the living things are valued (Lindemann-Matthies 1999). This level of appreciation is higher amongst girls than boys (Jäkel & Schaer 2004) and relates to an interest in wild plants. With regards to the level of interest, a peak was established amongst children up to class 5 which decreases during secondary level 1 (Weiss 1984). For this reason, focus on a pre-occupation with wild plants and learning about these should be in primary school and classes 5 and 6 of secondary level I.

An essential prerequisite for conveying knowledge of the species on wild plants is teachers' expertise of this subject (Berck 2001). It can generally be assumed that only few people know what is growing around them. Many have difficulties naming even common species (Zucchi 2007) and there are deficits even amongst students (Zucchi 2007; Moßner 1995; Bosch 2000). This should not, however, give the impression that the insignificance of wild plants in biology lessons is solely due to a lack of knowledge of teachers. Further factors also play a role here such as the school environment, curriculum and pupil interest which also has, as mentioned above, an important role in learning about wild plants.

Hardly any investigations exist on the significance teachers give wild plants and the knowledge of the species in lessons. This paper examines this subject.

As with wild plants, the situation is similar with *medicinal plants and home remedies*. Although knowledge of medicinal plants is passed on from generation to generation (Bühning 2008), there was a loss of interest a few decades ago and knowledge of this subject increasingly disappeared. It was only in the 1990s that there was a renaissance of homeopathy which brought with it a revival of interest in medicinal plants (Bergsträsser 2001). According to the Allensbach Institute for Public

Opinion Research (2002), in 1970, 52% of the West German population (formerly FRG) aged 16 years and above had already used natural remedies. In 1997, this time examining both East and West Germany, it was 64% and, in 2002, 71%. There was, however, not a further increase of users of natural remedies as, in 2010, the figure was 70% (Allensbach Institute for Public Opinion Research 2010). Of the people who did not use natural remedies (30%) only 7% rejected these completely. Possible reasons for this great willingness to use natural remedies could be an increased awareness of the risks associated with standard therapy methods and cost factors (Piel 2007).

The role of medicinal plants and natural remedies in schools was examined by means of a curriculum analysis by Bergmann (2009). This showed that, of the various school forms, natural remedies had lowest level of significance in teaching in the *Gymnasium*. In contrast, primary schools as well as the *Haupt* and *Realschule* incorporated the subject in various, also practical, ways.

The following hypotheses may be derived from these considerations for our investigation: Hypotheses on wild plants in teaching:

- Wild plants usually only have a small role in biology lessons as the publications quoted here indicate that pupils' knowledge of the species is, to a large extent, minimal.
- There are differences depending on the school form as the curricula of the primary schools and *Haupt* and *Realschule* (middle level secondary school) offer, with regards to wild plants, more freedom than the curriculum of the *Gymnasium*.

Hypotheses on medicinal plants and home remedies in teaching:

- Medicinal plants and home remedies have an even smaller role than wild plants in teaching as they are hardly addressed in curricula.
- There are differences depending on the school form as the curriculum of the *Gymnasium*, in contrast to the curricula of the other school forms, almost fully excludes these subjects.

Investigation Structure

The investigation was carried out in the form of a questionnaire for biology teachers. This questionnaire is divided into two parts: the first part examines the significance of wild plants in biology lessons whilst the second part focuses on medicinal plants as well as home remedies. As there are manifold ways of incorporating the named subjects (wild and medicinal plants as well as home remedies)

in lessons, subjects were differentiated in various areas and aspects of content.

The subject of “wild plants” incorporates six content areas which are each covered by 1-3 items (content aspects): Knowledge of the species (1 item), practical or useful aspects (3 items: natural remedies, foods, poisons/drugs), ecological aspects (3 items: habitat indicators, endangered plants, food sources for animals), geographic aspects (2 items: plants of other cultural areas, plants of other / non-indigenous habitats), chemical aspects (1 item: ingredients), cultivation aspects (1 item: from the wild to the cultivated plant).

The subject of “medicinal plants” incorporates five content areas which are characterised by 1-4 items (content aspects). Knowledge of the species (3 items: appearance of plants, creating a herbarium, confusion with other plants), plant acquisition (3 items: cultivation, collection, location), plant processing (2 items: testing formulas, storage of plant material), medicinal effects (4 items: areas of use, ingredient type, effect of ingredients, dangers of use), myths and stories (1 item).

The subject of “home remedies” partly, although not solely, relates to plant based treatment methods. The latter include teas as well as baths and onion packs. Remedies which are only partly plant based include wet packs/compresses (e.g., onion or cabbage wraps). In the case of the cherry stone packs, focus is on the heat storage ability not the plant ingredients. The home remedy of milk and honey also does not focus on the plant ingredients (apart from the nectar as nutrition for bees).

The above named items/content aspects were evaluated by the teachers with regards to their significance in lessons using the five-stage Likert-type scale. This scale ranged from 1=“no significance” to 5=“high degree of significance.” This assessment of the significance was in relation to current lessons (actual status) as well as the teachers’ ideal (target status). To highlight the differences between the actual and target status, significance tests according to Wilcoxon were conducted for the individual content aspects whilst significance tests according to Kruskal-Wallis were carried out for the differences between the school forms.

The questionnaires were sent to 30 primary and secondary schools within a radius of 15 kilometres of the city of Siegen. This is a city in Germany with about 100,000 people in a region which was formerly characterised by ore mining and forestry and is in the German federal state of North Rhine-Westphalia. Twenty-five schools participated in the

investigation including 7 primary schools, 6 *Hauptschule*, 6 *Realschule* and 6 *Gymnasium*. A little more than one-third (37.7%) of questionnaires were returned; 57 teachers took part. These are divided amongst the schools forms as follows: 16 primary school teachers (14 female/2 male), 14 *Hauptschule* teachers (9 female/5 male), 13 *Realschule* teachers (8 female/5 male) and 14 *Gymnasium* teachers (5 female/9 male). The ratio of male-to-female respondents in this random sample is not merely coincidental but can be traced back to the ratio of both sexes in the various school types.

Findings

Part 1: Wild Plants

The significance given to wild plants in lessons was assessed using the above listed content aspects and relates to both current lessons (actual status) as well as the teachers’ ideal (target status). The following chart indicates the average figures of actual and target status for each individual content aspect (item). For the actual status, we can see that no content aspect achieves a high (≥ 3.5 and < 4.5) or very high (≥ 4.5) level of significance. Instead, the majority of content aspects (7 out of 11) have a medium level of significance (≥ 2.5 and < 3.5). These content aspects incorporate knowledge of the species but also ecological, practical and cultivation aspects. Geographic and chemical content as well as the natural remedy content aspect (even though this also has a practical aspect) had a low (≥ 1.5 and < 2.5) and very low (< 1.5) level of significance in lessons.

Notable is the difference between the actual and the target values. For all 11 content aspects, the ideal status is significantly higher than the actual significance given to wild plants in lessons.

Differences relating to school type are only notable in the aspect “knowledge of the species” (actual status) and the aspect “indicators” (actual and target status) (Figure 2a and Figure 2b). All other aspects do not exhibit any differences with regards to school type. With the actual significance given to “knowledge of the species,” the primary school is ahead of the other schools types. However, this difference is, with view to the future significance of “knowledge of the species” no longer significant. For the content aspect “wild plants as indicators,” differences in significance given exist in both current as well as future biology lessons between the school types. This content aspect is given least significance in the primary school and greatest level of significance in the *Gymnasium*.

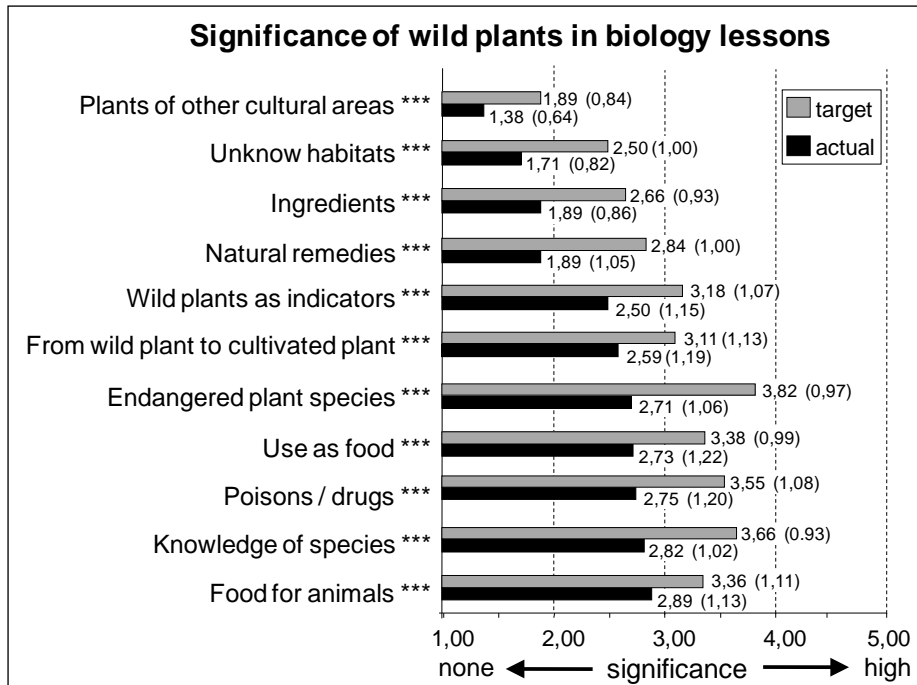


Figure 1. The significance of wild plants in today's (actual status) and ideal lessons (target status). N = 57. Likert-type scale of 1 (= no significance) to 5 (= high degree of significance). The figures correspond to average figures; those in brackets, the respective deviation from the standard. Significance tests (comparison of actual and target status) according to Wilcoxon. n.s.=not significant, *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.

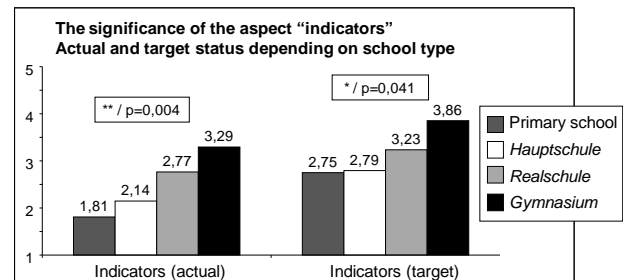
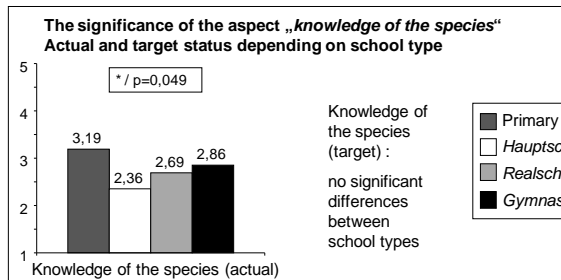


Figure 2a. The significance (averages) of content aspect "knowledge of the species" of wild plants. **Figure 2b.** The significance (averages) of content aspect "wild plants as indicators". Comparison of different school types with view to current and ideal lessons. N = 57. Likert-type scale of 1 (= no significance) to 5 (= high level of significance). Significance tests conducted: Kruskal-Wallis. n.s.= not significant, *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.

To sum up, there are hardly any differences relating to school type with regards to the significance of various content aspects of wild plants.

This finding applies to both current lessons (actual status) as well as the ideal lessons (target status).

Part 2: Medicinal Plants

The subject of medicinal plants can be divided into 13 content aspects (items) which can be allocated to five content areas. The following diagram shows the significance level of these different content aspects for both the actual as well as the target status in lessons. The findings are depicted in average figures.

Of the 13 content aspects it is only the “appearance of the medicinal plants,” a central aspect of the content area “knowledge of the species,” which is given a medium level of significance (≥ 2.5 and < 3.5). All other content aspects are only given small significance in lessons (≥ 1.5 and < 2.5). One aspect, the “storage of medicinal plants,” was even given a very low level of significance (≤ 1.5). The relative importance of knowledge of the species is also shown by the fact that similar content aspects such as “confusion with other plants” and “creating a herbarium,” have a higher value than other items (average ≥ 2.0 but < 2.5). The content area “medicinal effect” is also of moderate importance (average of items ≥ 2.0). Furthermore, the aspects which relate to the practical side of medicinal plants (e.g., “cultivation,” “collecting,” and “storage of plants” as well as “testing of formulas”) have a low to very low level of significance (average of all items < 2.0 , in one case: < 1.5).

Again notable here is the difference between the actual and the target status i.e. the difference between what is practiced today and the desired level. In the case of all 13 content aspects, the desired ideal status is clearly above the actual status in biology lessons. This difference between the actual and target status is particularly defined in the aspects “cultivation of medicinal plants” and “testing formulas.” With a difference in the significance level between the actual and target status of clearly more than one point on the Likert-type scale, this practical work is, from the teachers’ viewpoint, in strong need of improvement.

Furthermore, there was also an analysis of whether differences relating to school type exist with regards to the 13 content aspects in medicinal plants. This revealed differences in several aspects in both the actual significance (actual status) as well as the ideal status (target status).

For the actual status, there are significant differences between the school types in 5 of the 13 content aspects. These 5 content aspects include “appearance,” “usage possibilities,” “dangers in use,” “cultivation of medicinal plants,” and “testing formulas.” These five content aspects are each given considerably less significance at the *Gymnasium* than at the other three school types (primary school and *Real* and *Hauptschule*).

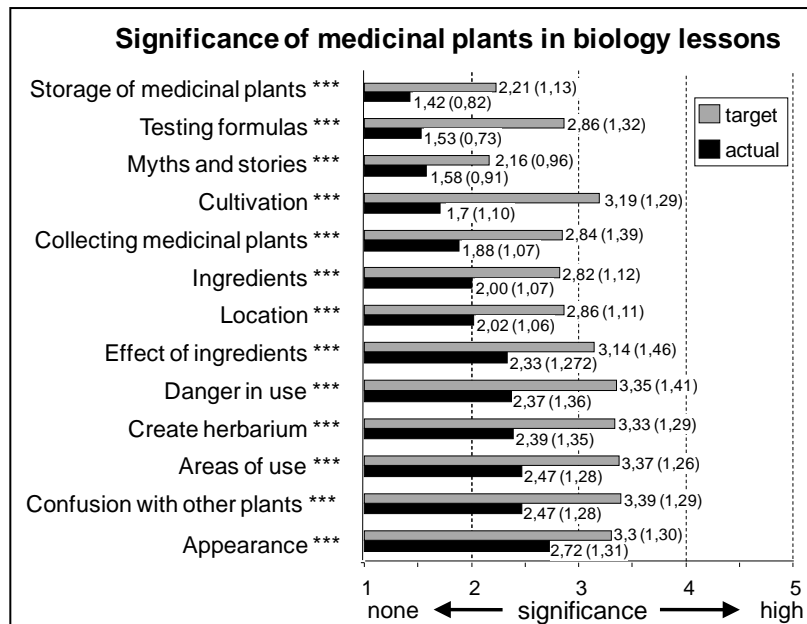


Figure 3. The significance of medicinal plants in current and ideal lessons. N = 57. Likert-type scale of 1 (= no significance) to 5 (= high level of significance). Figures correspond to average figures; those in brackets, the respective deviation from the standard. Significance tests conducted (comparison of actual and target status): Wilcoxon. Significance level: n.s.= not significant, *p ≤ 0.05, **p ≤ 0.01, ***p ≤ 0.001.

There are also considerable differences between the school types in the target status for 6 of 13 content aspects. These content aspects include “appearance,” “confusion with other plants,” “collecting,” “cultivation,” “testing formulas,” as well as “stories and myths” on medicinal plants. Also here, these aspects are considerably less important in the *Gymnasium* than in the other school types. The

teachers at the *Gymnasium* do, however, hope for an improvement in the significance given to the above subjects but as the actual status is low, the target status values are also below those of the teachers of the other school types. The following diagrams show the differences between the four school types.

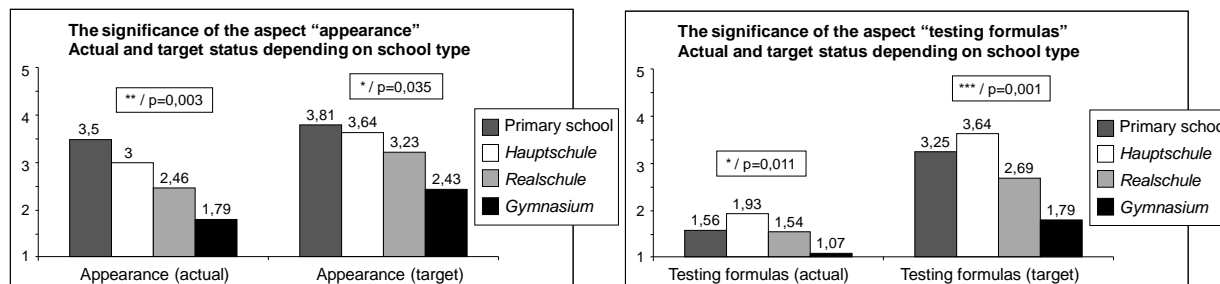


Figure 4a. The significance (averages) of the content aspect “appearance” of medicinal plants. **Figure 4b.** The significance (averages) of content aspect “testing formulas” of medicinal plants. Comparison of different school types with regards to current and target status. N = 57. Likert scale of 1 (= no significance) to 5 (= high level of significance). Significance test: Kruskal-Wallis. n.s.= not significant, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Part 3: Home Remedies

To establish the importance of home remedies in lessons, teachers were given six various home remedies which they had to evaluate according to significance given in current lessons and the ideal lesson. The following diagram shows the average figures for both actual and target status with regards to each of the six home remedies. The

average significance value in current biology lessons is under 2.0 for all home remedies which indicates that home remedies are not given much significance in lessons. As the diagram shows, a greater significance is given to all home remedies for the ideal lesson (significance growth of between 0.7 and 0.9 points on the Likert-type scale).

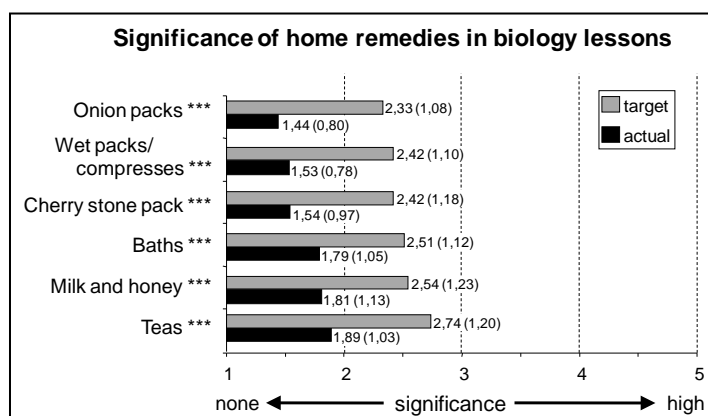


Figure 5. The significance of home remedies in current and ideal lessons. N = 57. Likert-type scale of 1 (= no significance) to 5 (= high level of significance). Figures correspond to average values; those in brackets, the respective deviation from the standard. Significance tests conducted (comparison of actual and target status): Wilcoxon. n.s.= not significant, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Furthermore, there are considerable differences in the significance of home remedies depending on school type. These differences refer to all home remedies analysed. Results are shown for the home

remedies “teas” and “milk and honey” below (Figure 6a and Figure 6b).

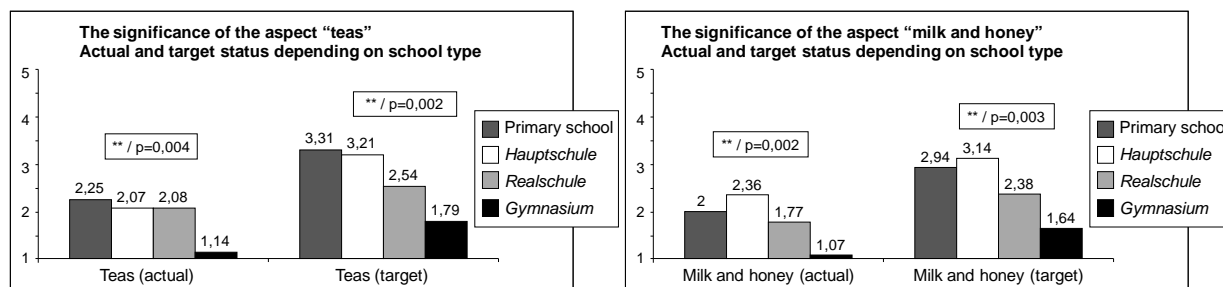


Figure 6a. The significance (averages) of content aspect “teas” as home remedy. **Figure 6b.** The significance (averages) of content aspect “milk and honey” as home remedy. Comparison between different school types with regards to current and ideal lessons. N = 57. Likert-type scale of 1 (no significance) to 5 (high level of significance). Significance test conducted: Kruskal-Wallis. n.s.= no significant, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Viewed overall, home remedies have almost no significance in lessons in the *Gymnasium*. The current level of significance at the other school types is also low (≥ 1.5 and < 2.5) and even very low in several content aspects in primary school (< 1.5 , with regards to wet packs/compresses, cherry stone packs, onion packs). Regarding the ideal state, all school types would like to see improvements here although the differences between the school types remain. As a result, the significance of home remedies will remain extremely low from a *Gymnasium* teacher’s viewpoint whereas the teachers at the *Hauptschule* and primary school strive for a medium level of significance.

Conclusion

At this point the hypotheses posed at the beginning of this article should be examined again. *Hypothesis 1* states that wild plants are usually given minimal significance in biology lessons. This hypothesis was confirmed. None of the content aspects surveyed were given a high degree of significance. The medium significance level of the individual items was always below 3.0 (Likert-type scale: 1=no significance, to 5=very high level of significance) whereby the average of all items was 2.35. However, teachers do not object to these subject areas but would like to incorporate them more into lessons. This would also be possible in keeping with the curricula of all the school types although the curriculum of the *Gymnasium* offers the least scope with regards to this (Bergmann 2009).

Hypothesis 2 states that there are differences in the significance level given to wild plants in lessons depending on school type. This hypothesis was not confirmed by

the majority. The differences in significance levels only occur in two content aspects. One of these (“wild plants as indicators”) is characterised by a greater complexity in content which makes it less suitable for pupils of the primary school and *Hauptschule* which is also why it has more significance in the *Gymnasium*. The second content aspects, “knowledge of the species”, involves basic knowledge (Berck 2001) upon which further knowledge in biology can develop (e.g. use of plants, cultivation, ecology of these species). As one of the main objectives of the primary school is to convey basic knowledge, it is understandable that the “knowledge of the species” is given greater significance here. To this also comes the fact that younger pupils have a greater interest in knowledge of the species (Weiss 1984).

Hypothesis 3 states that medicinal plants and (plant based) home remedies have an even lower level of significance in lessons than wild plants. This hypothesis was confirmed by the investigation. If all the content aspects are viewed equally, the average significance value for wild plants would be 2.35; medicinal plants, 2.07 and home remedies, 1.67. It can, therefore, be summed up that the more specialised the subject is, the lower the significance level in lessons. Another interpretation would be: the more practice orientated the subject is, the less important it is in school. However, teachers do not view medicinal plants and natural home remedies as entirely unimportant and this is indicated in the greater target status values.

Hypothesis 4 states that there are differences relating to school type in the significance of medicinal plants and (plant based) home remedies. This hypothesis was confirmed. Hereby the significance level of the

survey content was significantly lower at the *Gymnasium* than in the other school types. A reason for this could be that it is mainly women who are interested in medicinal plants and natural home remedies and who have the corresponding knowledge and appreciation for this subject. If the higher number of women at primary schools and the *Haupt* and *Realschule* is taken into consideration, then the higher level of significance given to medicinal plants and home remedies at these school types becomes more plausible. If the schools which lead to further education are examined, it is noticeable that medicinal plants and home remedies are often given greater significance in the *Hauptschule* than the *Realschule* and the *Gymnasium*. This is probably because there is a greater focus in the *Hauptschule* on preparing pupils for the practical aspects of life. The low level of significance at the *Gymnasium* can also be explained by the fact that the subjects in the curricula here correspond to a higher level of education and, therefore, require a certain degree of abstraction ability (Hentig 2007). The situation, therefore, arises that elementary things which are everyday at the *Hauptschule* are not learnt by pupils in the *Gymnasium*. As the subject of medicinal plants is (supposedly) not very challenging, these are omitted from the list of possible teaching topics.

Ways of Incorporating Wild and Medicinal Plants in Lessons

If we assume that the subject of wild and medicinal plants is given greater significance in schools, there are various methodical ways of involving this subject in lessons. However, empirical findings on the effectiveness of these methods are rare (Berck 2001).

Lessons as well as field trips convey knowledge of the species. However, if a teacher simply names the plants it does not automatically lead to pupils learning about them. To acquire this knowledge of the species, information on the biology of a plant (Zucchi 2007), the benefits as well as stories and myths should also be conveyed. These facts act as auxiliary knowledge and help pupils remember the aforementioned plants (Stichmann 1992). The auxiliary knowledge can be particularly comprehensive with medicinal plants. Moßner (1995) regards medicinal plants as being particularly suited to school lessons because of their ingredients and usage possibilities. A school garden with several medicinal plants to aid pupil learning would be ideal. Moßner's concept envisages the compilation of "identity cards" for medicinal plants (in the school garden) based on observation tasks and tests. Hereby the identity card includes the plant's key data with space for dried leaves, pictures and illustrations which can be created individually. Equally useful auxiliary knowledge is provided by

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spice plants which mainly belong to the mint and umbelliferae families (Brauner 1993). Also here, pupils can learn the characteristic features relating to the respective examples for use in the kitchen. As this involves a type of food, all senses of the pupils could be addressed. This also shows that focus is on conveying not only knowledge of form but also on everyday use. A quiz on spice plants would be a further option for learning whereby pupils have their eyes covered and have to guess which plant they are holding in their hand. As there is often little time in biology lessons because of all the material which must be learnt, the time-saving "five-minute biology" method based on repetition could also be considered. With this method, pupils learn three new plant types per week which are presented to them within five minutes (Stichmann 1992). Teachers bring plants with them to lessons and present information on their location as well as select auxiliary knowledge. Here it can be helpful to label the respective plant locations on a map or a sketch plan which is displayed in the classroom and to which further species are added every week. Photos and diagrams can also be added to the plan for improved visualisation. Further options for developing knowledge of the species, besides the actual lessons, are: picture displays which are permanently kept in classrooms, plant exhibitions in display boxes, competitions at school festivities which offer a prize if species are named correctly, quartet games and the independent creation of a herbarium (Czinczoll 1988). This list may also be complemented by plants the pupils bring with them and caring for indoor plants in the classroom. If teachers want to focus on classifying plants, field guides may be used. For beginners, it is advisable to choose books which enable identification by flower colour and form. Books which focus on text-heavy, dichotomous identification keys and which require knowledge of various plant characteristics are less suitable. One question has, so far, remained unanswered: what species should pupils learn about in schools? The choice is difficult because of the immense diversity of the species. To create comparability in at least one school, it is advisable that teachers agree on a common species list. This selection of the species could be orientated to the following criteria according to Stichmann (1992):

- Frequency
- Conspicuousness
- Significance for humans
- Role of tradition
- Exemplary for lessons

For pupil's interest and attention can be promoted by making the species appear remarkable (Stichmann 1992).

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