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Working Paper
Report of Results WP2.1
Estonia

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2 Methodology

This research was carried out **using focus group methodology**, i.e. demonstration of different tools and free discussion in a small group after every demonstration.

Two separate focus groups were created – one for the primary and secondary school level, and another for the university level. Teachers of primary and secondary schools were united into one focus group because usually the same teachers teach on both levels in Estonian schools (including the teachers who participated in the focus group); however, tools for different school levels were discussed separately.

The focus group meetings were carried out in January 4, 2008 at 11.00–14.30 (school teachers) and in January 9, 2008 at 14.15–16.30 (university lecturers) in the Institute of Ecology and Earth Sciences, University of Tartu (Lai Street 38, Tartu, Estonia).

3 Sample

Seven teachers participated in the **focus group of school teachers**; they all (except one) teach on both school levels, primary and secondary, as majority of Estonian schools contain both teaching levels in the same institution. One teacher teaches currently on the secondary level only (teacher of a Gymnasium, without the primary level) but has earlier experience of teaching in primary school as well. Two teachers are from the schools / classes where biology is taught officially in wider extent (additional biology lessons, so-called specialized classes). The age of participating teachers was between 33 and 56 years. They represent the schools from different parts of Estonia, both towns and countryside. All participating teachers are members of the Estonian Society of Biology Teachers which means that they represent more active part of the whole contingent of teachers.

Eight teachers participated in the **focus group of university teachers**; three of them teach on the highest level (incl. Ph. D. students), the rest of them teach students of both bachelor and master level. The age of participating teachers was between 34 and 59 years. All participating teachers represent the University of Tartu which is the leading university in the biological education in Estonia.

4 Results

4.1 Current Usage of Tools

Majority of participating **school teachers** (6 out of 7) have used computer in their lessons, mainly PowerPoint slideshows; some have used local tools which are available in the internet (see http://www.ut.ee/biodida/indexpr.htm). The usage of internet tools has been teachers' own enthusiasm, their usage is not obligatory according to the official curricula.

All participating **university teachers** have used computer in their lectures and practical works; PowerPoint slideshows are the most usual way of presenting any lecture; demonstrations of different facilities which are available in the internet (e.g. lists, databases, search function etc) are also common. Identification of different organisms is an ordinary task in various university disciplines; it is carried out either during the field courses or during practical courses in the lab and has usually been performed using keybooks. One participating person has used and compiled identification keys based on Lucid for his scientific research.

4.2 Perception of presented Tools

4.2.1 Tools for Primary Teachers

4.2.1.1 Woodlice

This tool was preliminarily introduced by the PowerPoint presentation and then directly online. The first reactions after demonstration were extremely positive. The tool is considered very didactic in many ways. The strengths of the tool were listed.

(a) The choice of the subject – woodlice represent a group of organisms which are usually not noticed at all or, when noticed, considered to be one single species. Introducing many species in this group should give a signal to the children that biodiversity in many other groups might be much bigger than usually thought.

(b) The key is really easy to use, the thesis / antithesis are presented in the way that the answers could be only 'yes' or 'no' (it is easier construction than the situation where thesis describes one state of character(s) and antithesis another state which might differ from the thesis only in minor details).

(c) The possibility to send one's data or notes to the museum and get the feedback.

(d) The possibility to compare the distribution maps of scientists and those compiled on the data from pupils. May give an additional impulse to start looking for the woodlice.

(e) The general biodiversity info is cleverly incorporated into the tool and related to the information about woodlice.

(f) The design of the tool (except the colours) is very attractive for the children (e.g. even minor details as constantly moving antennae of the images of woodlice).

Although the choice of the subject was pointed out as a strength of the tool, it can be interpreted also as a weakness in some aspects – woodlice may be not so easily found in

some conditions (bigger towns); the specimens of some other groups of organisms (e.g. snails' shells) could be preserved for long time and thus be used also during the lessons in wintertime.

No proposals were made to improve the application of the tool. All participating teachers were willing to use this tool in their lessons although discussion arose who should fullfill the functions of NHM in the local conditions (teachers do not feel that they are able to overtake these functions).

4.2.1.2 Key to common trees and shrubs in Estonia

This tool (http://dbiodbs.univ.trieste.it/carso/scuole?sc=35) was generated specifically for Estonia during December 2008 as **Key to trees and shrubs of a nature trail in Slovenia** is not usable in our nordic flora. Still, it is based on the same database (Dryades), generated in the same way (Frida) and is of similar construction. The key is available in English and in Estonian, the latter version was introduced in the school teachers focus group. The key includes 52 taxa, all common tree and shrub species plus ordinary fruit trees and some introduced trees which often grow in the parks.

The tool was demonstrated online. The spontaneous reactions after demonstration were very positive. The tool is generally considered very useful and the acceptance by the pupils is presumed to be affirmative.

Only the dichotomous key was demonstrated as multi-criteria interface is not currently available. Anyway, the principles of that interface were introduced to the teachers as well. The teachers clearly prefer the dichotomous interface because both options between which the user should choose are attractively illustrated in the dichotomous key and this makes it very suitable for the smaller children. The selection of included taxa was generally approved; still, a few additional species were suggested, especially from the group of introduced trees which are now widely used in the parks and private gardens. The teachers do not find necessary to prefer the species of local flora in such key if the species of introduced trees are also widely distributed.

All participating teachers agreed that they were willing to use such tool in their lessons although it is not officially included in the school curricula. Still, it would totally depend on the enthusiasm of the teacher as the official curricula is very intense and must be passed anyway. Usage of similar tools would be easier and more reasonable in the specialized biology classes (with additional biology lessons). They also think that some other teachers whom they know may refuse from the acceptance of such tools meaning that they do not want to decline from the usual teaching routine. NB! Teachers participating in the focus group represent more active part of all biology teachers.

A few proposals were made to improve the practical usage of this key.

(a) Prepare a separate sheet (to be added to the section 'Instructions') with the explanations and drawings of some botanical terms which are used in the key (e.g. position of leaves, types of inflorescenses). This is meant especially for the teachers (and not so much for the pupils) who can introduce then these terms before starting the

identification. This is also good as it helps to connect application of interactive keys in the lessons with the official school programs.

(b) Add maps of Estonian distribution to the final sheets of species, so that a pupil of any place in Estonia could check whether the identified species has been recorded from this locality earlier. Helps to arise pupils' 'sporting' interest, contributes to the geographical knowledge (even small children should be able to find their home town or community on the map).

Of three possible media (CD-ROM / mobile / web) the CD-s seem most applicable for teachers as in some schools there may be problems with the internet connections and in other schools the connection may be not fast enough. Mobile versions are not realistic to be implemented in Estonia at the present situation as the technical characters of most widely used mobile phones are not suitable for these applications. Possibility to print out the key is also important as sometimes it is useful to take the key out to the fieldtrip.

4.2.1.3 Mobile Application

Not introduced.

4.2.2 Tools for Secondary Teachers

4.2.2.1 Earthworms

This tool was preliminarily introduced by the ppt presentation and then the according homepage ('National earthworm survey') was demonstrated online. The tool itself is being developed just now and is not available online yet. Thus the interactive possibilities were described, but not introduced practically.

The spontaneous reactions after demonstration were rather positive. The following remarks were mentioned.

(a) The key is clearly more difficult than those which were suggested for the primary school, thus are indeed suitable for the secondary level. Some teachers suggest that this key should be used as a tool in a smaller group of pupils (not individually) – few characters shown on the PowerPoint slides are not so easy to identify and this means that pupils in the group can discuss and argue with each other.

(b) Photos attached are of good quality and of great help in the identification process.

(c) Additional equipment (hand lens) would be necessary or at least helpful.

(d) The short introduction to the morphology and anatomy of earthworms is highly appreciated.

(e) The possibility to submit one's results about the research and to get the feedback is most inspiring for the schoolchildren of the secondary level.

(f) The supporting information on the biology of different earthworm species is highly appreciated (today this information is available online about three taxa). It is also good that the external related link is added, children like to surf in the internet.

(g) The teachers would like to apply that kind of key in their lessons but there could be difficulties in bringing living specimens into the classroom. Alternative (go to the field with the pupils) might not be possible on many occasions.

(h) If used in the classroom, the internet version or CD will be preferred; in the field it would be good to have an outprint as well.

4.2.2.2 Key to common trees and shrubs in Estonia

The same tool introduced in 4.2.1.2 was discussed. The opinions were very much the same as presented by the teachers of primary schools.

Further proposals were made to improve the practical usage of this key.

(a) In the section 'Instructions' it should be emphasized that if the characters on your specimen are not quite the same as described in the thesis / antithesis, then it is always possible that you have got a (rare) species which is not included in the key. In some cases (e.g. species of Salix) the remark 'Many other similar species exist' should be added at the end of the identification process, while clicking the name of the species.

(b) Add some more tree species (e.g. Taxus baccata, Pseudotsuga sp., Abies sp., Betula nana, B. humilis). Not only common but also unfrequent or rare tree and bush species could be included in the key for pupils of the secondary level.

(c) Not only distribution maps but some short lists of most essential characters of each species would be highly appreciated. The pupils of secondary level can be attracted not by beautiful pictures only, they may be interested in learning and remembering of diagnostic characters of different species as well (this might be a facultative task, only for those who want this themselves). Full descriptions of taxa would be too long and and may be not of great use while additional ecological information could be suitable – the pupils quite naturally want to know more about the species which they succeeded to identify. At present no any additional information about the species is available.

The acceptance of this tool by the pupils is presumed to be affirmative and the teachers would like to use it in their lessons although in the present situation it would be an additional task both for the pupils and the teachers (not directly included in the curricula, applying would depend on the good will of the teacher).

4.2.2.3 Mobile Application

Not introduced.

4.2.3 Tools for University Teachers

4.2.3.1 Bumble Bee

The tool was demonstrated online, both html and Flash versions. The tool is available in English and this is no problem for the university students. The spontaneous reactions after demonstration were very positive. The tool is considered very attractive and the acceptance by the students is presumed to be affirmative. It is probably applicable in the practical courses as well as in the form of independent homework.

The following remarks were mentioned.

(a) 'Identification tips' are very valuable as they help the students to acquire some specific skills necessary to perform the identification process.

(b) The choice of the subject – the bumblebees represent taxonomically a very complicated group of species in which different generations and specimens from different geographical areas may vary greatly in their colour patterns. Therefore this tool is suitable indeed on the university level where students should have somewhat critical attitude toward the result of their identification.

(c) Flash version is very attractive indeed and students probably would like this version best. The teachers themselves still prefer the html version.

(d) A lot of additional information is available (list of taxa, distributon maps, nomenclatural remarks etc), incl external links of related subjects. It is possible to organize the teaching work in two steps: to perform the identification of specimens during the practical course in the lab, and work through the additional information independently at home.

(e) The possibility to submit one's results about the identified taxa and get the expert feedback would be an additional attraction for the students (although it is supposed that the university teacher ought to be a specialist and able to give appropriate feedback himself).

4.2.3.2 Key to the Flora of Val Rosandra

The tool was demonstrated online in the English version. The key is available in five languages (but not in Estonian); the university lecturers do not see any problems in using the key in English. The general opinions were very positive and all participating lecturers were willing to use the similar tool in their disciplines. Many biology lecturers have practical courses where the identification of organisms is a usual task, so no difficulties in finding the suitable opportunity to use the interactive keys in the teaching process. The acceptance of the tool by students is supposed to be positive. Of three possible media (CD-ROM / mobile / web) the CD-s and web are both suitable in the university courses. Mobile versions are not realistic to be implemented at the present situation.

The following remarks were made.

(a) A great number of photos is highly appreciated. It is good that the photos demonstrate both details and general outlook.

(b) Distribution maps are also very useful – students may be positively irritated if they identify a species from the locality which is not marked on the map.

(c) Additional information of each species (short lists of diagnostic characters or even full descriptions, ecological data, nomenclatural history etc) will improve the usage facilities of the tool in the university.

(d) Dichotomous interface is preferred to the multi-criteria query interface because the options in the former interface are effectively illustrated.

(e) The possibility to create dichotomous keys of remaining taxa at every step of identification is a good facility; furthermore, these keys can also be printed out if necessary.

(f) No possibility to start again from the beginning of the key (if something went wrong somewhere), just 'Back' button??

4.2.4.3 e-flora iberica

This tool was introduced by the ppt presentation because online version was not available yet when the focus group meeting took place. It was evident that some aspects of the tool were therefore not properly understood (e.g. possibilities of entering free text, the working principle of diagrams that show relations between the species). This was probably the cause that the spontaneous reactions and general opinion after demonstration of the tool were less positive than about other introduced tools. Still, the tool was interesting and majority of participating lecturers wanted to see how it really works online.

All three interfaces (free text, fields = multi-criteria query, and dichotomous) were demonstrated. Free text interface would need additional instructions – how 'free' the text can be, how many words can be entered, botanical terminology necessary or not etc. Dichotomous interface seems to be the most similar to the traditional keys while its Interactive possibilites were not clearly understood in PowerPoint presentation (options seem to be not illustrated). Multi-criteria interface was the most intriguing.

The possibility of entering restrictions (families, genera, provinces) was highly appreciated.

The working principle of diagrams that show relations between the species remained unclear; furthermore, it was puzzling whether these diagrams show really phylogenetic realtionships between the taxa or just phenetical similarities.

Species pages include additional information (short description, nomenclatural, distributional and ecological data, and evidently also pictures) and this is considred very positive.

4.2.3.4 Mobile Application

Not introduced.

4.3 Development of Tools

These tools which contain, besides the key itself, additional data about the species (short descriptions, nomenclatural or ecological data, distribution maps) are evaluated higher by both the school teachers (especially those of secondary level) and university lecturers. Teachers agree that this would enable to use these tools for different purposes, such as for the identification – to introduce the biodiversity by this process – and for learning more about some species by the pupils / students who are interested in that kind of knowledge. Adding of distribution maps is suggested in the first order.

Adding of some information to the sheet of instructions is suggested.

(a) Explanation of specific terms together with drawings or photos of them (as in the tool about earthworms or bumblebees). That kind of 'glossary' would surely contribute to the identification process but can also be used as a separate tool (not connected to the key). The tools based on the database of Dryades with richly illustrated characters in the theses / antitheses are well usable; however, even these tools might have a separate 'glossary' which can be opened when terminological questions occasionally arise.

(b) An explanation is necessary to point out that the process of identification is some kind of creative action, and your result may sometimes turn out to be wrong (if your characters are not exactly the same as those presented; if you have occasionally picked up a rare species or an unusual form) and what to do then. Emphasizing of different possibilities would benefit the activity and creativity of pupils.

5. Summary

All school teachers and university lecturers who participated in the focus group meetings were very positive about the demonstrated interactive tools. They all said that they are interested in using such tools in their teaching work, they find them attractive and useful and they assume that children like working with them.

However, the school teachers were hesitating whether the practical identification using keys can be managed in ordinary schools during usual lessons as the official curricula is very full. This would totally depend on the enthusiasm of teachers. Furthermore, although

all schools in Estonia have separate computer classes where these tools can be applied, the classes are pretty much over occupied, and again – it would need the teacher's certain activity to reserve the computer class and have possibility to use the tools. Mobile applications are generally considered not applicable (due to technical reasons) in Estonia at the present moment.

University lecturers were pretty sure that they can use similar tools during their present courses as predescriptions for their courses are rather flexible and the lecturers can influence the content of the courses a lot.

6. Recommendations

(a) Tools of primary and secondary school level must be in local languages while university tools are easily used if they are in English (but not in German or Spain).

(b) The possibility for printouts of interactive keys is generally highly appreciated by the teachers – for their own needs (to get an overview of the key, to work through the whole key before introducing it to the pupils in order to feel selfconfident).

(c) The possibility to get an additional information about the identified species is another valuable function of these tools. Just keys without any further links may be reasonable on the very primary education level but even small children like to use different functions of the computer. Therefore, various links, both internal (inside the tool) and external, will make the tools more attractive for the youth. This means, of course, that the development of interactive tools would take more time and other resources.