

## **Gesamtschule Schwerte: auditing the acquirement of sustainability knowledge\***

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### **Background and Aim**

Since the mid-nineties Gesamtschule Schwerte has been working towards environmental conservation, e.g. an extracurricular group "environmental conservation" has been founded and a photovoltaic unit has been installed.

As one of the first schools in Germany to perform an Eco-audit according to EMAS in the academic year 1997/98, the school hoped to comprehensively consider, evaluate and improve the impact of all the school's activities on the environment, and hoped to establish a reasonable connection between environmental protection and environmental education. The results were compiled in an environmental policy and an environmental management system was initiated, setting up the aims of environmental protection and also an environmental programme.<sup>1</sup>

In 2001 the school performed a second audit to see how well their aims created after the first audit had been met, and to reconsider, or, if necessary, to change the planned direction of the actions. This second audit found that compared with the situation at the time of the first audit, environmental education now formed a real point in the school. By means of a spot check with the use of a questionnaire, the school wanted to see to what extent all the extra efforts in implementing environmental care and education had truly reached the pupils. This enquiry laid bare the strong and weak points of the programme and allowed the school to draw conclusions for the formulation of new aims and programmes.<sup>2</sup>

In 2006 the school created, as part of a third audit, an extended questionnaire for all pupils. This aimed at answering the following main questions:

1. To what extent have the self created aims of the school been met? What kind of impact resulted from the environmental and sustainability education?
2. What are the "essentials" the pupils want to see considered in the future planning?
3. What basis is now available for the continuation of activities in environmental and sustainability education? That means which interests, motivations and attitudes of the pupils form a basis for further programmes? Which facts aid or inhibit the motivation to stand up for environmental protection and sustainability in our school?

\*This is the paper-version of a lecture at the Finnish-German Cooperation Seminar "Sustainability in Schools" in Helsinki, 2007-04-03, for more details see [www.umweltschulen.de/audit/duesseldorf/finnland.html](http://www.umweltschulen.de/audit/duesseldorf/finnland.html)

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1 Documentation see [www.umweltschulen.de/audit/schwerte.html](http://www.umweltschulen.de/audit/schwerte.html)

2 Documentation see [www.umweltschulen.de/audit/schwerte2001](http://www.umweltschulen.de/audit/schwerte2001)

These questions places the Gesamtschule Schwerte within the federal movement “education for the development of sustainability in schools”, which was particularly initiated and advanced within the two BLK model programmes “21” and “ Transfer 21”.

The central learning aim in both the model programs is competence within the organisational process ("Gestaltungskompetenz").<sup>3</sup> There are, however, up to now serious deficiencies in the operationalisation and organisational competences.<sup>4</sup>

Based on this the Gesamtschule Schwerte questioned the pupils as follows:

forms 5 - 7	forms 8 - 10	forms 11 - 13
General environmental protection (on a global as well the school scale)		
TOPIC: waste	TOPIC: energy	TOPIC: genetic engineering
reference: waste project week of year 5	reference: energy project of year 10	reference: project gene technology of year 12
the four columns of the school program:		
environment care; partnership among the genders; justice; peace keeping		

Additionally, some data was asked about the participants to be used as background information for the evaluation.

Proceeding in this way the Gesamtschule Schwerte reached self-ascertainment at a simpler level, than the evaluations of the operational competences would have been. On the other hand, they got a more ample evaluation of their activities in environment and sustainability education than many other schools did, using only the feedback of the pupils of single projects of their sustainability audit.

### Approach and realization

In 2004 the Gesamtschule Schwerte started the preparation of a third audit.

It was planned to be performed with external help - as was the case in the two previous ones. Since the school failed to obtain external financial support, the school and its Förderverein decided in winter 2005/2006 to subdivide the third audit into several steps and to start with the inquiry of the pupils, financed by the school.

In tight coordination between the school and the present author the following steps were taken in spring 2006:

- Formulation of leading questions

<sup>3</sup> de Haan, Gerhard / Harenberg, Dorothee (1999): Bildung für eine nachhaltige Entwicklung. Bonn: Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK)

<sup>4</sup> Rode, Horst: Motivation, Transfer und Gestaltungskompetenz. Ergebnisse der Abschlussevaluation des BLK-Programms “21” 1999-2004. Berlin: Verein zur Förderung der Ökologie im Bildungsbereich e.V. Online-Dokument, URL: <http://www.transfer-21.de/daten/evaluation/Abschlusserhebung.pdf>, zuletzt überprüft: 12. 1. 2006

- Interview with the environment team concerning the present state of environmental and sustainability education at the school
- Definition of scope and topics of the investigation. It should be made possible to questions all pupils; it should be organized as efficient as possible, preferably done during a lesson hour. Collection and evaluation of data to be done using the computer programme GrafStat .<sup>5</sup>
- The results should be used to pose hypotheses of increasing quality with an increase in age of the groups.
- Concrete explanation of the exploration and fixing of the items to be explored
- Formulation of a questionnaire in text form
- Formulation of a questionnaire using GrafStat with partial differentiation concerning the content of questions for the respective age groups in such a way that each age group is faced only with the questions to be answered by them, but nevertheless to manage all results of the inquiry under one single data project/data base. Installation of the data collection point onto the internet.
- Test of the questionnaires concerning understanding, running on the PC pool of the school, function of the data collection point
- Interim checks of the data coming in
- Interim evaluation of data and discussion with the audit team in November 2006
- Final evaluation and preparation of the report in the first half of 2007.

### **Classification of the inquiry**

Inquiry of pupils is an effect evaluation; additionally it contains parts of a product evaluation. In effect evaluating the learning arrangements are taken as "Black Boxes"; what is estimated are only changes (e.g. in knowledge by means of an inquiry) and these are then relayed to the learning arrangements. In product evaluation also the connections between the causes (learning arrangement, its process, aims and planning) and the effects are to be measured and understood. To this end additional activities are necessary, e.g. reviewing of documents, observations or stimulations of teachers to make reflexions on their work<sup>6</sup>.

The inquiry to the three concrete projects was done in a quasi-pre-test-post-test design. This procedure contains two classical empirical designs of evaluation:

- Design of test groups vs. control groups, i.e. parallel inquiry of participants vs. non-participants in an educational measure. This approach in Schwerte could

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<sup>5</sup> [www.grafstat.de](http://www.grafstat.de) (English Version is available!)

<sup>6</sup> Slotsch, Gerald (2003): Ungerichteter Aktionismus oder tatsächliche Veränderung – Instrumente der Evaluation. In: Deutscher Forstverein 2004, S. 46-61. Zitiert nach: Schulz, Sylvia: Evaluation einer Kurzführung am Nationalparkzentrum Königsstuhl. Universität Rostock 2007, S. 43

not be used since the projects of inquiry in each case were done with the whole respective age group, thus a control group was not available.

- Pre-test-post-test design, i.e. inquiry of the same group of participants before and after the educational measure. In this case the inquiry should have had to last the whole school year, and this was impractical because of the too long duration<sup>7</sup>.

Therefore to evaluate effects of projects, in each case pupils of three consecutive years were posed the same questions. Thus, the elder pupils in each age group have participated in the respective project, but the younger ones had not.

In the inquiry age group of 11-13 the design test vs control group could partly be applied, because in Schwerte some of the pupils attended the school since year 5 (forming the test group), whereas some have attended the school only since year 11, thus forming the control group. Thus two groups for comparison are available at beginning of form 11, but in form 12 and 13 the "new" pupils also become members of the test group.

## **Hypotheses**

The inquiry is based on hypotheses that contain statements concerning the Expected effects of the activities in the school in the field of environmental care and sustainability development. These hypotheses in a general form are as follows:

- One effect of the projects should be a marked increase of knowledge of the pupils on the topic of the respective projects. (In the eldest age group this should be not only knowledge of facts about the topic but rather also the capability of the pupils to develop and to advocate personal positions to critical themes.)
- The knowledge of pupils on basic problems of environmental protection should increase during the school time.
- This knowledge in 2006 should at least meet the level of 2001.
- Pupils in the age group 11-13 who had already attended years 4-6 at the Gesamtschule Schwerte should at least be as well informed in environmental topics as those having attended secondary school elsewhere.
- The pupils should accept the four columns of the school program as their own positions.

Verification of these hypotheses may be taken as an indication of successful work in the school.

Further steps (refinement of the hypotheses, formulation of the questionnaire, data procession) will not be detailed here.

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<sup>7</sup> Bittner, A. 2000: Wirkungs- und Konzeptevaluation von Umweltbildung am Beispiel des nationalparks Harz/Niedersachsen. Allg. Forst- und Jagdzeitung, 11 (2000), S. 195-204 Zitiert nach: Schulz, Sylvia: Evaluation einer Kurzführung am Nationalparkzentrum Königsstuhl. Universität Rostock 2007, S. 44

## **Data collection**

Between September and December 2006 each class of the Gesamtschule Schwerte school visited the computer department once, for the duration of one lesson, to answer the questionnaire. To do this, the pupils had to download the questionnaire appropriate for their age group from the intranet as an html document. The questions could be answered with verbal statements or by selection out of the several options given. After working through the questionnaire, it was to be sent to the data collection point on the internet. For further processing the present author downloaded the data using the programme GrafStat.

Data safety and avoidance of misuse was largely secured by exclusive access to the questionnaire via the school intranet and guarding of data acquisition from the internet via a password.

## **Data procession and evaluation**

The questionnaire mainly contained closed questions, i.e. the pupil was asked to select one or several answers out of the given options. Data processing was done as follows:

- Counting the answers for each of the given options
- If possible: summarizing the answers; counting the number of answers per category
- Number of answers per category in the respective age group
- Number of answers with respect to gender

The raw material for all the evaluations was obtained with the GrafStat programme, followed by manual data transfer into the program Open Office Calc<sup>8</sup> to obtain more appealing diagrams.

The evaluation of open questions to be answered with free text was much more laborious:

- Data provided via GrafStat as text documents were imported into Open Office Calc.
- Evaluation was made by a stepwise increasing abstraction from the answers. The first step followed the qualitative content analysis according to Mayring<sup>9</sup>, i.e. the statements were paraphrased and generalised (divided into various paraphrases and transferred to a more general linguistic level); then followed the formation of categories. Particularly remarkable statements were marked in the table document and/or quoted in the report text.

The categories formed were then evaluated as had been done with the closed questions. At the present moment, this evaluation has been done only on the level

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<sup>8</sup> Which is an pendant / alternative to Microsoft Excel

<sup>9</sup> Mayring, P. (2002): Einführung in die Qualitative Sozialforschung. Weinheim und Basel: Beltz. 5. Auflage, S. 114ff

based on all answers given; the differentiated evaluation with respect to the age groups has yet to be done.

In the following some selected results based on 800 usable questionnaires will be presented and discussed.

### **Selected results**

#### Knowledge about the greenhouse effect

Question 4: Which gas plays the main role in the -made greenhouse effect?

Reduction of the anthropogenic greenhouse effect is one of the major challenges mankind is facing in the 21st century. The school and also every pupil contributes by their energy consumption to CO<sub>2</sub> emissions.

The following answer options were given, only one was to select:

water vapor (H<sub>2</sub>O)

ammonia (NH<sub>3</sub>)

sulphur dioxide (SO<sub>2</sub>)

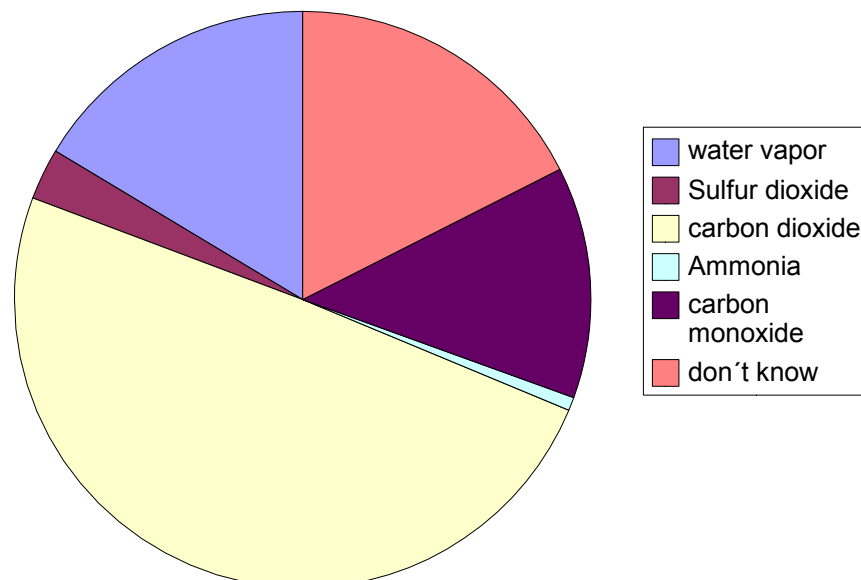
carbon monoxide (CO)

carbon dioxide (CO<sub>2</sub>)

not known

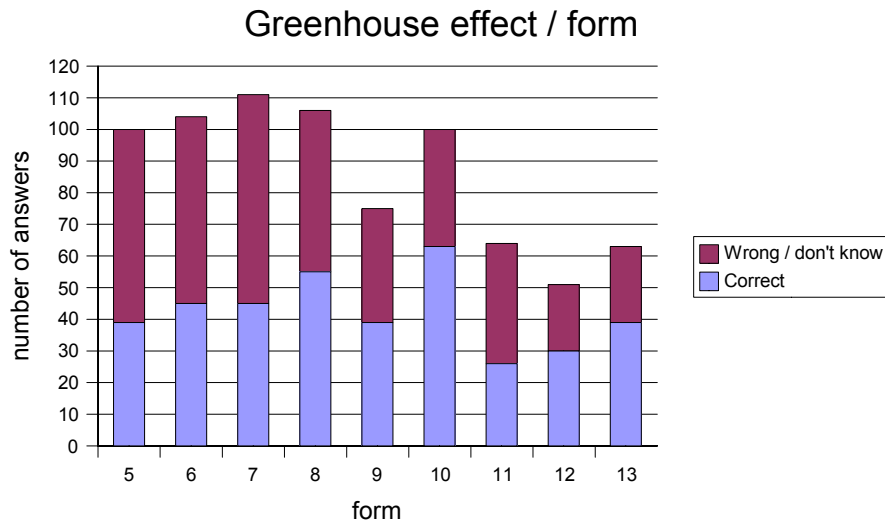
Of 783 pupils having answered this question 49.4 % gave the correct answer. In the inquiry of 2001 this figure was 66.5 %.

### **Greenhouse effect**

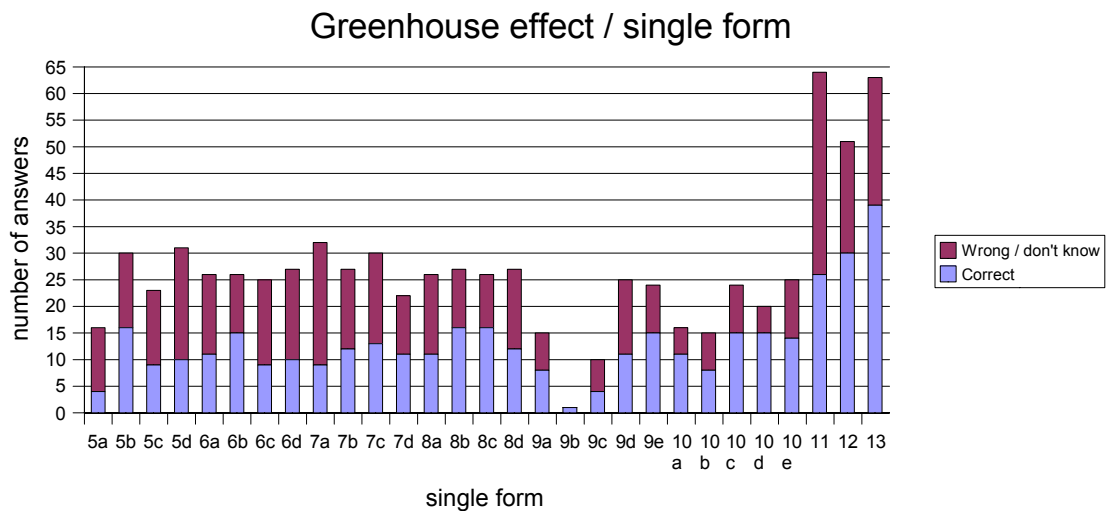


For further evaluation two categories were formed: "correct" and "wrong/not known" (containing all other answers).

It is conspicuous that already in the younger classes relatively many pupils know the correct answer (43 % in class 6), although neither the topic greenhouse effects nor the chemicals asked for had been dealt with in lessons. The years 8 and 9 show equal results (51.9 vs 52 %), year 10 is clearly better, 63 %. Strikingly weaker is year 11 (40.6 % correct answers) although in the preceding year the energy project was performed.

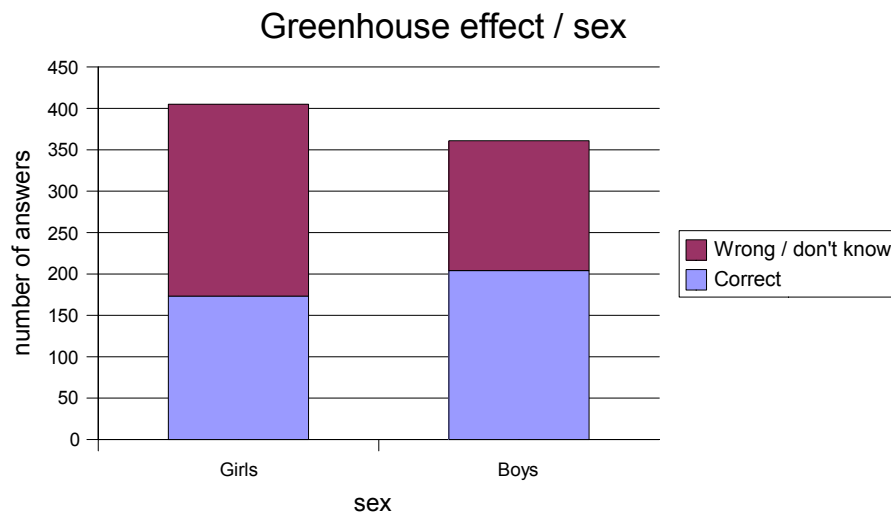


Differentiation between the single classes in each year group revealed considerable differences between parallel classes, e.g. of class 10e and 10 d (56 vs 75% correct answers.)



178 pupils of year 13 have answered this question and additionally indicated their duration of attendance at the Gesamtschule Schwerte.

- Of 108 pupils attending the Gesamtschule Schwerte since year 5, 60.2% gave the correct answer
- Of 57 pupils who came to the school in year 11, 43.9% had answered correctly



In this question boys clearly did better than girls (56.5 % vs 42.7 %)

### Waste separation

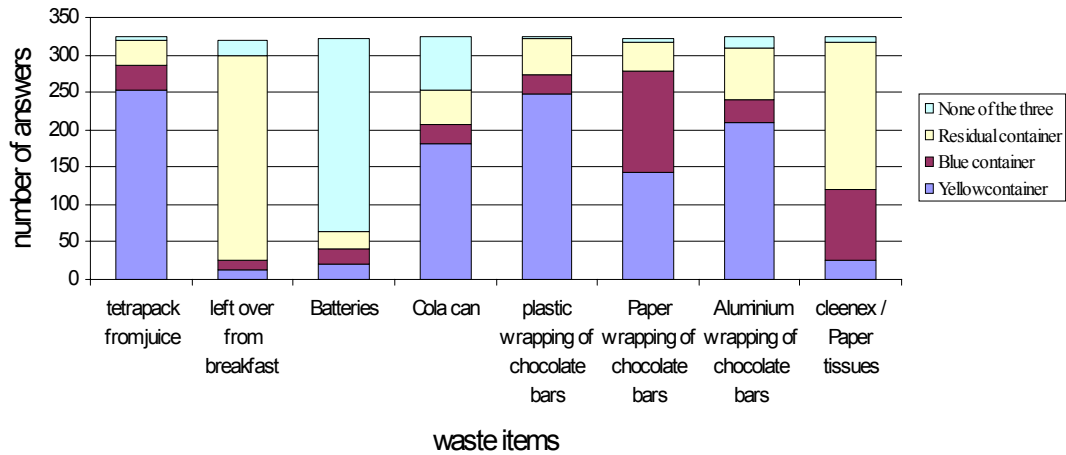
Questions 12-19: In our school waste is separated. For the following kinds of waste, please, indicate the proper container!

Collection of separated waste has for many years been a substantial part of the environmental management system at the Gesamtschule Schwerte. Although in the Federal Republic waste separation is not unquestioned from the point of view of environmental policy (issues: waste avoidance is more important; reasonable recycling of light-weight packaging is questioned) for the school this measure without a doubt resulted in a considerable reduction of the expenses for waste removal.

In the questions the pupils were asked to decide into which different containers the various waste items should be disposed (yellow/blue/residual/none of the three). Only one answer was allowed. This question was posed only to years 5-7.



## Waste separation at school



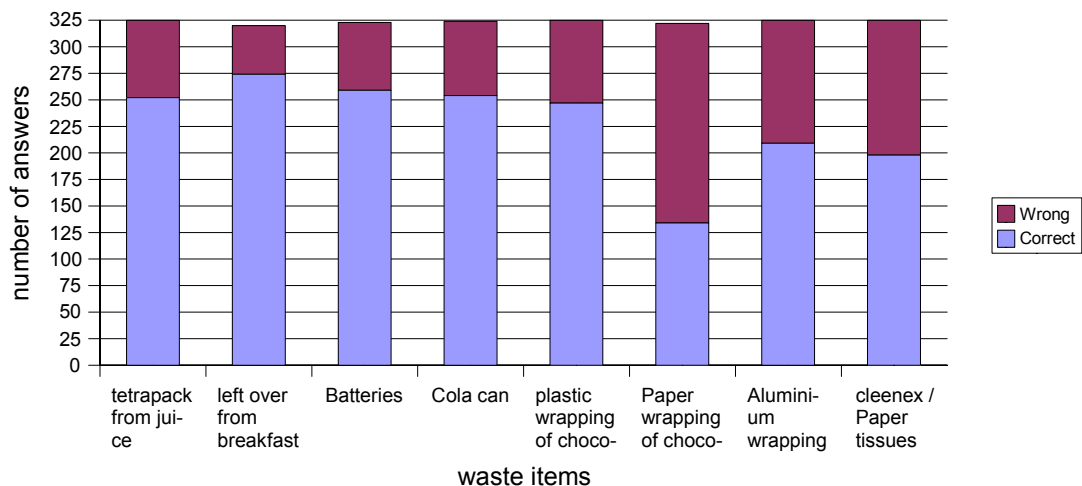
Of 327 Pupils 324 (99 %) of pupils answered this question.

Since there were changes in environmental policy due to the introduction of a deposit policy for cans in FRG after the beginning of waste separation at the school, two options for cola cans were accepted (yellow bucket/none).

Removal of paper tissues in residual waste and not in waste paper is the official rule of the school.

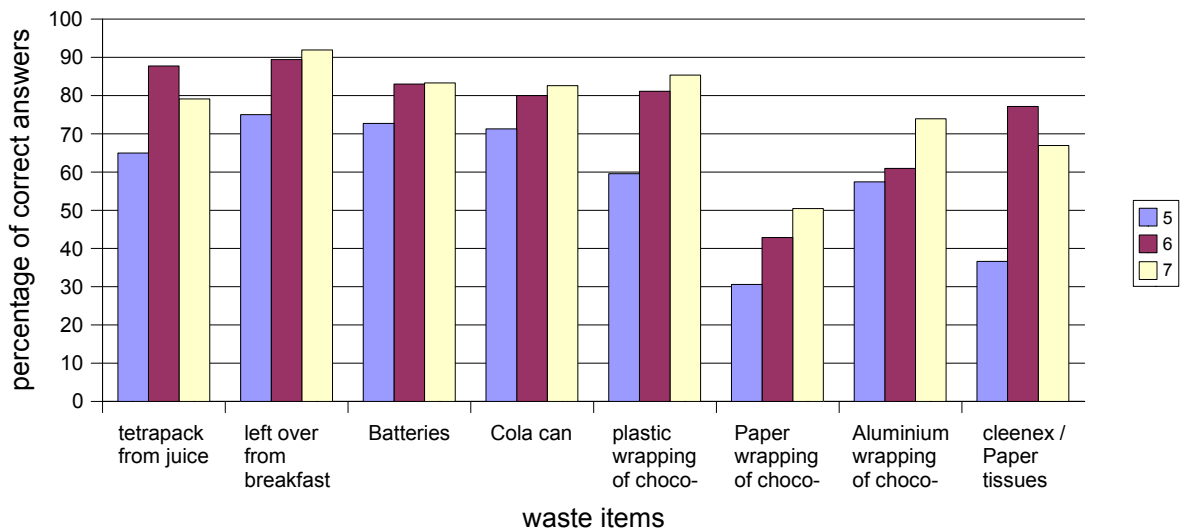
Under consideration of these special facts the answer options could be grouped into the categories “correct” or “wrong”

## Waste separation at school



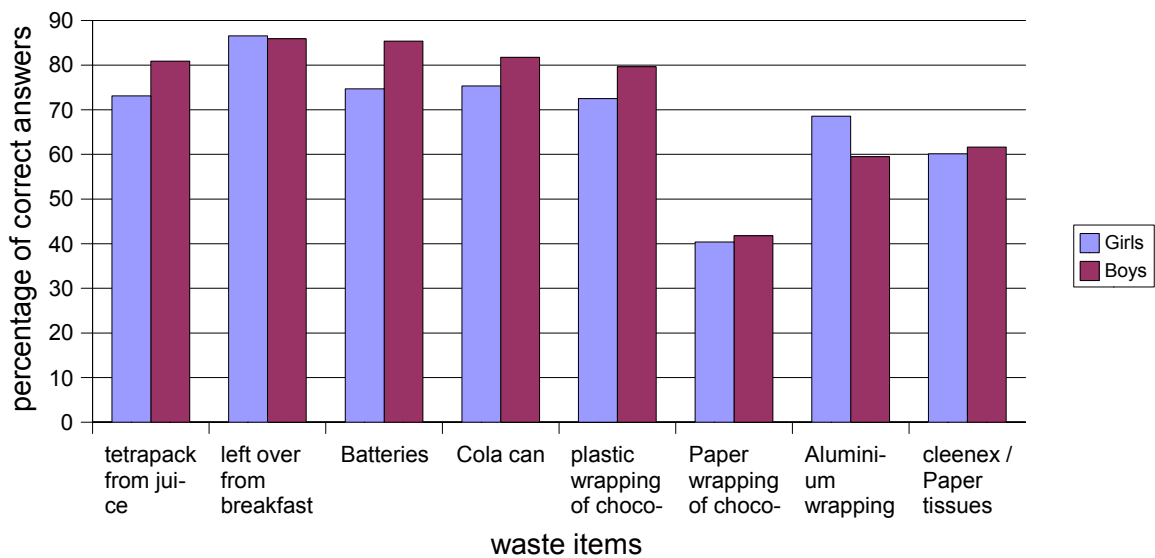
As a result, overall we can state that between 60.9% (paper tissues) and 85.6% (rest of breakfast) of the answers were correct, provided we consider the question concerning the “paper of chocolate bars” as a throwaway question as this question was misunderstood by many pupils.

## Waste separation at school / form



As expected, knowledge of the correct separation of waste increased with age. Pupils in year 5, however, already perform rather well. At the time of the inquiry they had not yet done the waste project, but had had the school regulations on separation introduced to them.

## Waste separation at school / sex



In these questions boys only marginally did better than girls, 72 vs 69 %.

## The four columns of the school program

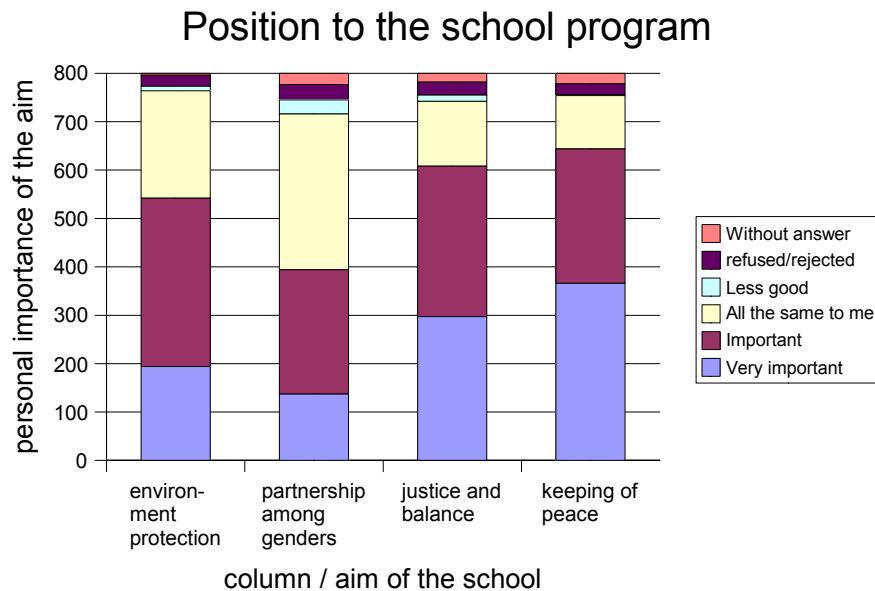
The school program at the Gesamtschule Schwerte follows the ideal of sustained development, and there were declared four leading points as founding columns, which the school aims at:

- Environmental protection
- Partnership among genders
- Justice and balance between north and south, rich and poor
- Keeping of peace

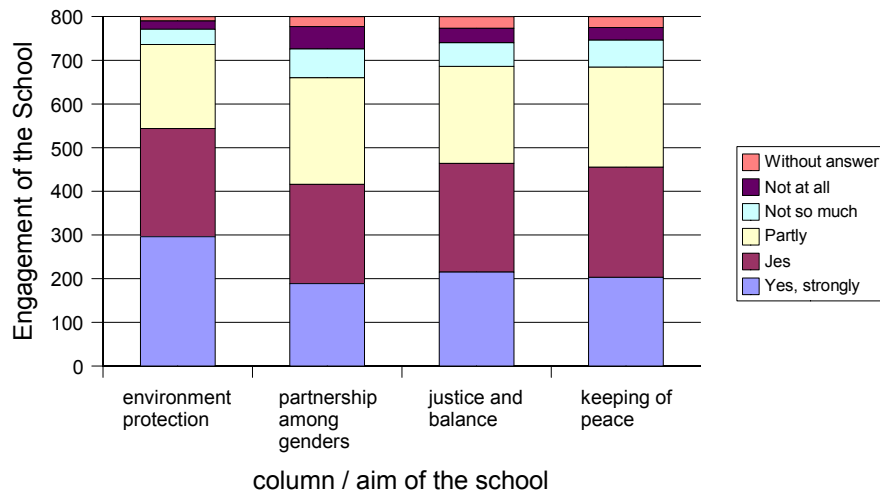
Three questions were posed concerning each of the three columns:

- personal importance of each of the aims (very important - important - all the same to me - less important/good - rejected)
- what is your concrete idea about this aim (open question, answered with free text)
- do you think your school is seriously engaged to follow this aim (e.g. via projects, practical measures; giving examples; representation in lessons etc.)  
Answer categories: yes strongly - yes - partly - not so much - not at all

The following two diagrams summarize the answers to questions 1 and 3.



## Engagement of the School



As is clearly visible, environmental care is rated 3rd in importance for the pupils, but with respect to the school credibility (its own environmental care) it is placed at 1st position. That means, although for the pupils environmental care is not their highest priority, they acknowledge the engagement of the school in the process. This is a fine success for all environmental activists! Partnership of the genders, however, in the answers to both the questions ranges at the last position.

This is underlined by the answers to the open question: "What is your idea for achieving this aim?" Two thirds of the pupils were not willing or able to give a usable statement to the column "partnership of genders".

In the further evaluation we will examine whether the pupils with respect to the single columns developed desires referring to others or whether they felt a joint responsibility for their own needs.

<b>Example peace keeping - the most important column in view of the pupils</b>		
<b>Main category</b>	<b>Sub category</b>	<b>Number of students with at least one argument in the category</b>
desires/hopes	no violence, no conflict, no mobbing, equality of rights	88
	no racism, no fascism, no violence on these grounds	24
	peace, peace in the world	123
joint responsibility / actions comprises	actions (demonstrations etc.)	15
	solidarity with war victims, partnership with other countries	4
	learning (intercultural learning, learn to remain non-violent, projects, lessons, information)	23
	peaceful behavior	32
	solving of conflicts/quarrel	9
	other aspects	8

Question 48: "what do you concretely imagine under the aim "peace keeping"? - selected statements:

*To get knowledge of different cultures that are quite different from our culture. Many people have prejudices concerning such cultures, and this can be changed by better knowledge. Things like this are never topics in our lessons, for me it would be very important to learn about such aspects. (girl, year 8)*

*Racism and fascism are explained already in school so that one can act against them and also against mental attitudes favouring war or similar things (boy, year 10)*

*To solve quarrels and not allow hate (girl, year 10)*

*War is really silly shit (boy, year 9)*

*I have no idea how a school can help to prevent a real war, but in our class even little quarrels were solved well (girl, year 8)*

*I think this means to better understand one another, also that in our school no racism or things like that occur and that - irrespective of ones appearance or origin from any other country or being rich or poor and so on - in spite of all such differences all should accept each other (girl, year 10)*

*You really want to know what I think about peace?!?!? That is, I think, peace is the direct opposite to war. I personally hold peace to be very important, but sometimes*

*there is no other option, then drastic measures are necessary, even violating peace. But generally – better not. (boy, year 10)*

*First we should take measures to have no violence here, at our school (girl, year 6)*

*That at our school there is no violence, also not with words, against other pupils or foreigners (boy, year 6)*

*When you have a friend in your class and you have a quarrel with him/her, you are very sad and feel alone and lonely. When you are reconciled again with the friend, this makes you happy again. I do like peace very much. (girl, year 6)*

*That there is no glorification of war lords and no war occurs. (girl, year 7)*

*I think equal rights in every aspect is an important aspect of peace. (girl, year 9)*

### **Evaluation and conclusions (extract)**

#### Topic: waste

The following hypotheses were to verify:

In the “waste” project week the children become acquainted with environmentally friendly materials for school use and with waste separation. They got to know the respective procedures in our school and were motivated to apply them.

- Pupils of classes 5-7 showed a good to very good knowledge of the behavioural instructions of the school (sale of environmentally compatible school materials; waste separation). Solely the recyclable drinking bottle "Emil" is only insufficiently known one. This can be taken as a success of the efforts in environmental education at the school. There is, however, a wide gap between knowledge and the appropriate actions (rather a minority of pupils/by far not all pupils will follow their better knowledge in every-day actions). Since the system of environmental management at school is in need of participation of all the concerned people, there is a continuous demand of information on waste problems.
- Knowledge about external aspects of environmental policy (signs of environmental care; benefit of use of recycled paper etc.), however, is only average.
- In almost all topics we see an increase in knowledge in classes 5-7
- The pupils in year 5 as an example, demonstrated a rather advanced knowledge even before having done the waste project week. This knowledge is hardly acquired outside school because it concerns mainly behavioural instructions at the Gesamtschule Schwerte. The conclusion seems obvious that representation of certain behavioural guidelines at school and the continuing publicity work help a good deal to develop knowledge in all questions of environmental care. Therefore one can regard these guidelines

and instructions as a very important and successful component of environmental efforts at school that by all means should be retained.

- Since the pupils already before participation in the waste project had a relatively advanced knowledge in the respective behavioural instructions of the school, and considering that this knowledge does not really increase during this project week one should reconsider and adapt the aims and contents of this project. Perhaps more complicated backgrounds of environment policy (symbols of environmental care; benefit from use of recycled paper) should be included.

#### The four columns of the school program

The inquiry revealed a rather differentiated picture about the vividness and acceptance of the four columns of the school programme. Peace keeping and justice are seen as the most important. Concerning activities in environment protection, the school's actions are respected. The fourth column, partnership of genders, however, had not yet really come to life.

The younger pupils in general were more open to these four columns and gave them a higher importance within their own life, whereas the elder groups were more critical and in doubt on the credibility of the school's actions on these topics.

It is still undecided which consequences the school will take from these evaluations.

#### Knowledge development during the school career

The Gesamtschule Schwerte started a systematic extension of their activities in environmental protection and environmental education after the first Eco-audit in 1997/98. Thus all pupils which attended this school from the very beginning find themselves confronted with and are involved in these activities. Therefore an increasing knowledge in environmental problems and environment protection is expected over the years at school.

- A positive example may be taken from the genetic engineering project. Year 11 did not know some of the special subject-specific terminology and therefore had considerable difficulties in reasonably discussing the open questions.
- Pupils attending the school since year 5 showed a slight markedly better knowledge compared with those who attended the school only after year 11.

At a more general view, however, this effect is less pronounced than expected:

- Pupils of year 5 already have a relatively high knowledge only a few weeks after their entry into the school. This comprises also more specific aspects of the environmental management system of the school.
- However, the percentage of pupils giving correct answers in knowledge inquiries decreases from year 8 to 10, 11 and even to 12.

- Evaluation of three selected questions showed differences in knowledge between parallel classes, which were partially clearly more pronounced than differences between the age groups. In several questions some classes, on the other hand, did much better than the average. Therefore to attribute these differences to "a particularly active class in environmental protection" or as caused by a "teacher particularly active in environmental topics" is not an plausible explanation.

This brings us to the conclusion that besides the didactically planned projects and lesson units, there must be other factors strongly affecting the acquisition of knowledge. These may include:

- Previously acquired knowledge that the pupils bring with them
- Informal learning
- Learning in the practical courses offered in the school and the accompanying publicity work
- The model function of the teachers guiding the class can more or less stimulate learning activities
- Forgetting and pushing away of learned contents during personal development

From these items the school may draw the following conclusions:

- In addition to lesson units and projects, further learning and practical activities should be offered in the future.
- Aims and contents of such projects should as much as possible take into consideration the previous knowledge already acquired by the pupils.
- Quality safeguarding in projects is necessary to secure the realization at a high and comparable level in parallel classes and over the years.

### **Limits of the investigation; discussion of mistakes**

The reported inquiry was the first of this size done at the Gesamtschule Schwerte as well as by the present author. Thus several lessons can be drawn from the problems that occurred. They will be discussed briefly in the following:

#### Methodology of the inquiry

The pupil inquiry presented has been realized as a product of evaluation. The concrete learning situations have been taken as "black boxes"; what has been tried to be examined was: did the expected effects occur? Such a procedure, of course, can only result in a limited increase in our knowledge.

An evaluation of the concept could have resulted in an additional investigation of the pedagogic and environmental political reasons of the aims of the educational



measures and their realization <sup>10</sup>. Concerning the waste project week we could have checked how far the documents provided to the respective teachers considered the aspects of the pupils inquiry (analysis of documents) and how far the teachers used their individual freedom of teaching in realization of the concept (inquiry of teachers). A process evaluation could have compared and evaluated the real situations of interaction and the intended pedagogic concepts of action<sup>11</sup>. Visitations during the waste project week could have given information on the interest and motivation of the pupils and could have shown how they could be activated, or to what detail the ecological benefit of recycled paper could be mediated in the different year groups.

The external support of the school for the pupil inquiry worked on the project for four weeks. Evaluation of one single open question with 800 answers takes at least one day. Many more resources are necessary to perform a more profound investigation.

### Realization of the inquiry

Originally the realization of the inquiry was planned during the summer vacations 2006. Due to delay in the preparation the realization was postponed until autumn 2006.

This resulted in a situation where at the time of inquiry none of the classes to be questioned on the energy topic had already done the energy project. Therefore only the question concerning the greenhouse effect-put to all pupils, could give information on the effect of the energy project.

For organizational reasons the inquiry took several weeks. Therefore it is possible that the pupils had time to talk about the questions which resulted in better preparation of the classes that were later questioned. This source of falsification, however, should not be overestimated since

1. the importance of the inquiry was mediated to the pupils rather defensively (it is no examination; no marks are given) and
2. the answers to several questions even in parallel classes or different age groups revealed better as well as weaker results.

We can conclude that for an optimal success of an inquiry project of this size a long-term planning, and an exact keeping to the time schedule are necessary preconditions for success.

### Questionnaire

In some of the questions a repetition occurred, i.e. more or less the same facts were asked for so that attentive pupils could conclude the answers from one and apply it to the other. This concerns, for example, question 21: "Which form of renewable energy is in use in our school?" and the subsequent question: "How much electrical power

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<sup>10</sup> Slotsch, Gerald (2003): Ungerichteter Aktionismus oder tatsächliche Veränderung – Instrumente der Evaluation. In: Deutscher Forstverein 2004, S. 47. Zitiert nach: Schulz, Sylvia: Evaluation einer Kurzführung am Nationalparkzentrum Königsstuhl. Universität Rostock 2007, S. 50

<sup>11</sup> See above, page 48

has the photovoltaic unit of our school already produced?" - being implicitly the answer to question 21. We can see from the answers of the pupils that not many of them took advantage of this repetition.

In questions 15 and 22 only one answer option is strictly correct, but a second one would also make sense. This is unfavourable for the evaluation. We solved this problem in the Schwerte inquiry by accepting both the answers.

These examples demonstrate how important extreme carefulness is in the formulation of a questionnaire - which is true for the questions as well as for the respective answer options.

### Data processing using GrafStat

After sending a filled in questionnaire to the data collection point this programme does not clear the screen. This makes possible an unintended - or intended and repeated! – second sending. Such clearly redundant data sets are easily recognized in case of verbal answers. GrafStat allows cancelling of such data. Double data sets, however, are only distinguishable if they are identical in all answer points, including even the individual orthography in text answers. In our case altogether 26 data sets had to be cancelled as obvious doubles, so that 800 sets remained.

We cannot guarantee that this figure is identical with the complete figure of participants. Also cannot be checked is whether pupils actually present in the computer room did or did not send off a questionnaire. The figure 800 however corresponds very well with the school officials' idea, so we take 800 as the number of all participants in the inquiry.

Also we cannot check the personal data (mainly with respect to gender). The age group however can be checked by comparing the questions posed, since the three age groups had to answer partly varying questions. This allows for a certain proof of plausibility.

Of course, there are technical and organisational means to avoid at least part of the problems mentioned. E.g. GrafStat offers the possibility to add TANs (transaction numbers) to inquiries. Each participant is given a TAN allowing only one single filling and sending of the questionnaire. All other data sets or ones with wrong TANs are ignored by GrafStat during the data import. This option, however, would mean greater problems for the teachers. It also shows how important keeping the balance between the means needed for the effects desired and the expected results is in an inquiry of such size.

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