(online) = ISSN 2285 – 3642
ISSN-L = 2285 – 3642
Journal of Economic Development, Environment and People
Volume 3, Issue 4, 2014

URL: http://jedep.spiruharet.ro
e-mail: office_jedep@spiruharet.ro

Knowledge, attitudes and behaviour regarding waste management options in Romania: results from a school questionnaire

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Abstract.*This study analyses knowledge, attitudes and behaviour in the area of different waste management approaches of pupils in Romania. Examining school students' knowledge about waste management options and finding out the reasons that prevent them from participating in environmentally sound disposal options is essential for teachers and legislators. For this purpose, questionnaires were designed and distributed in two schools in Romania.*
The analysis revealed that knowledge is highly developed in Romania regarding the potential of recycling, while the concepts of waste management technologies are far less known about and understood. Landfill is seen as a problem for human health and the environment. However, recycling behaviour is low - partly as a result of limited possibilities. In general, the treatment hierarchy that is recommended in the "European waste hierarchy" is only partly reflected in students' attitudes towards waste management options.

Keywords: Waste management, waste hierarchy, waste reduction, sustainable development, Romania

JEL Codes: Q20, I20

1. Introduction

1.1 Waste management and sustainable development

The area of waste management, an essential part of sustainable development, is dealt with in many different ways in EU member countries (Mazzanti & Zoboli, 2008; European Environmental Agency 09; Pires, Martinho, & Chang, 2011). How municipal waste is perceived by the population (and in particular by the young generation), is of importance for understanding how teachers can increase relevant knowledge among students - and indicates what environmental education programmes have to focus on in the future. The younger generation is of particular importance because they will shape future developments and because it is believed that they will promote strategies and beliefs in their homes and will thereby act as

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(online) = ISSN 2285 – 3642
ISSN-L = 2285 – 3642
Journal of Economic Development, Environment and People
Volume 3, Issue 4, 2014

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"multipliers" for positive environmental behaviour (Boerschig & De Young, 1993; Larsson, Andersson, & Osbeck, 2010; Vaughan, Gack, Solorazano, & Ray, 2003).

While many EU member countries have advanced waste management systems, this is not the case in Romania, which only joined the EU in 2007 (Lopotaru, A. 14). Many regions in Romania are not covered by a kerbside collection service and landfill sites are still regularly used as the sole management options (Plesea & Visan, 2010; Apostol & Mihai, 2012). There is little research on societal perceptions of waste management in Romania. To the best of my knowledge, my study which uses questionnaires to look at students' perception of waste management options in Romania is the first of its kind. The current study tries to indicate aspects that not only teachers and educators but also policymakers, should focus on in the future so as to improve the waste management situation in Romania.

In the current paper, questionnaires were distributed to students in Romania and analysed to understand the current situation, limitations and needs in the area of waste management. The current principles of the EU, which are reflected in the EU waste hierarchy, are the context in which the Romanian waste management system is judged and the answers of the students are interpreted.

1.2 The EU waste hierarchy

The EU waste hierarchy is currently widely accepted as a conceptual framework which lays down both the best and the least sustainable ways to deal with waste (see Figure 1). It became legally binding for EU member countries in 2008 (European Commission 12).[1] The main goals of the waste hierarchy are the prevention of waste, the saving of energy and the conserving of resources (Schmidt, Holm, Merrild, & Christensen, 2007). The best option, according to the waste hierarchy, is to avoid the production of waste. The second best option is to re-use waste. This will save a maximum of resources and energy while still producing waste materials. However, in many cases, it is not possible to simply re-use waste materials. Recycling is the option of choice if it is not possible to re-use the materials concerned. According to the waste hierarchy, composting is on the same level as recycling. Energy recovery through incineration is the next best option. However, it should only be applied when the above mentioned possibilities are not feasible. Finally, disposal of waste by putting it on landfill sites is the least favoured option according to the waste hierarchy (European Parliament and European Council 08).

[1] Member countries can decide to deviate from the waste hierarchy for individual waste streams if there are environmental reasons for it (European Commission 12: 49).

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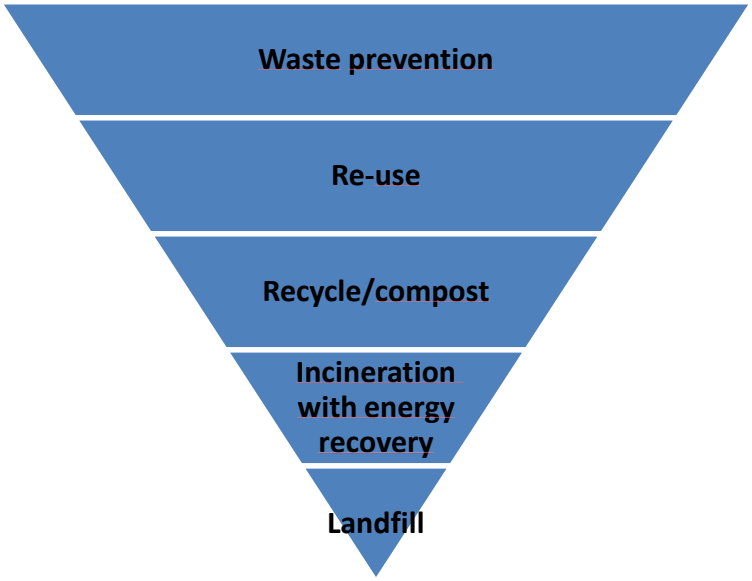

Fig. 1:. The waste hierarchy as described in the EU Waste Framework Directive.

1.3 Situation of waste management in Romania

Romania, which joined the EU in 2007, landfilled over 212 kg of household waste per capita in 2012, which is over 75% of its waste production (Eurostat 14a). While the country has started to close small, uncontrolled landfill sites, there is still a large number of landfill sites "protected merely by a fence enclosure" (Lavagnolo, 2010: 1752). In many regions, a working waste management system is non-existent (Plesea & Visan, 2010). Despite the fact that the Romanian waste management system is less developed, people living in Romania produced on average only around 270 kg of household waste in 2012 which is much less than the EU average of 487 kg (Eurostat 14a). Nevertheless, even these relatively small quantities have influenced the environment and human health negatively in the past (Krüger & Carius, 2001: 7; Lopotaru, A. 14). Moreover, waste quantities are currently rising as a result of increased consumption and Western-style packaging (Bird, M. 10).

The principles that are detailed in the waste hierarchy are therefore currently not taken account of in Romania: the least good option – landfill – is used for the majority of household waste. Incineration with energy recovery, which would be better than landfill, is not used at all since it is considered too expensive at the moment (Almasi, A. M. and Reichel, A. 13: 13). However, there are plans to build incineration plants in the near future (Lopotaru, A. 14). While recycling rates are increasing there are no large scale systems for waste collection and recycling in many regions. Equally, composting is not performed at the national level (Eurostat 13). Re-use of waste is difficult to assess. It can be as trivial as repairing clothes and shoes as much as feasible or using returnable bottles made from glass or resilient plastic instead of one-way plastic bottles. Finally, the best way to deal with waste is to not produce waste in the first place. This can potentially be done in any country. However, if a country has low rates of waste production it is considerably more difficult. Also, waste is up to some point a by-product of economic growth and per

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Journal of Economic Development, Environment and People
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capita income (Mazzanti, 2008; Beede & Bloom, 1995), therefore, a country such as Romania, which has experienced significant economic growth in recent years (Eurostat 14b), will find it difficult to implement strategies in the area of waste reduction.

1.4 Research question

Waste management is influenced to a large extend by societal factors, e.g. by the perception of waste among the population, by the knowledge of people about waste and possible management routes, and by potential obstacles that prevent people from participating in waste management schemes. The research question of the current paper is, whether pupils in Romania agree with the hierarchy of waste management options that is recommended by the European Union, despite the fact that the country is currently not treating its waste accordingly. The study also analyses reasons why students do not participate in recycling possibilities and thereby identifies educational needs in the area of waste management for Romanian schools.

2. Method

To explore knowledge, attitudes and behaviour in respect to waste management among students in Romania, an explorative approach was chosen. Questionnaires were designed and distributed in two Romanian comprehensive schools in 2009. The schools that were chosen were situated in small towns, each with a population of around 40,000 people. The questionnaires were translated into Romanian by a translation agency and were cross-checked by Romanian teachers. Participating pupils were between 14 and 15 years of age. A total of 105 students were questioned, 58 female, 47 male. The questionnaires were handed out to all students of each school on the same day and were filled out anonymously in class.

The questionnaire had been piloted previously with differently aged students. Younger students (below 11 years) had problems with the questionnaire while the questions were well-understood by students from the age of 13 onwards.

The questionnaires encompassed multiple choice and open-ended questions on knowledge about waste management, attitudes regarding waste management options and behaviour in the area of waste recycling.

The first part of the questionnaire was developed to identify the level of knowledge and the general importance of waste-related concepts. Students were confronted with different waste management concepts: Recycling of paper, kerbside collection services, household waste recycling centres, composting of garden and kitchen waste, incineration and landfill of waste. Students where asked whether 1) they had never heard of the concept, 2) had heard of the concept but did not know what it meant 3) had heard of it and knew what it meant.

Moreover, pupils were asked about the importance they placed on different waste management options. Answers were given on a 10 point scale with 1 being least important and 10 being most important. The aspects that were named are 1) reduce the amount of waste, 2) recycle our waste, 3) compost organic waste and 4) re-use waste.

In the second part of the questionnaire, the following approaches towards waste which are laid down in the waste hierarchy were addressed: Landfill, incineration, recycling and waste reduction. Students were

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Journal of Economic Development, Environment and People
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asked about their associations with the word landfill, whether they thought incineration is a good option to treat waste, whether they recycled and if they did not, what the reasons for their non-recycling were and finally, whether they thought that the amount of waste produced should be reduced and why they thought so.

Quantitative and qualitative approaches were used to analyse the students' questionnaire. Multiple choice questions were analysed by providing cross-tabulation and calculating frequencies.

Answers to open-ended questions were grouped into categories to allow better comparison. Categories were cross-checked by another researcher, discrepancies were discussed. Answers which were only given by one student were compiled under a specific section which is called "other".

3. Results

3.1 Knowledge about recycling concepts

The questions on knowledge of different waste management concepts were used to get an understanding of what students in Romania currently know. The results are summarised in Table 1.

Table 1. Knowledge of students

	Have never heard of it	*Have heard of it / don't know what it means*	*Have heard of it / know what it means*	*Missing answer*
Recycling of paper	5.7	2.5	91.8	0.0
Kerbside collection services	23.8	12.4	60	3.8
Composting of garden and kitchen waste	54.3	21	22.9	1.8
Incineration	9.5	8.6	78.1	3.8
Landfill of waste	19	12.4	66.7	1.9

The results reflect the situation in the country to some extent. Paper is one of the few materials which is often collected and recycled in Romania. There are also awareness campaigns at school which focus on paper recycling (Almasi, A. M. and Reichel, A. 13: 6). Consequently, over 90 percent of the students had heard about "recycling of paper" and knew what it meant.

Contrary to this, over 23 percent of the Romanian pupils had never heard of kerbside collection services. This lack of knowledge of the Romanian pupils can probably be explained by the current absence of such collection services in large parts of Romania. Only around two thirds of the students questioned stated that they knew what kerbside collection services were.

The concept of composting garden and kitchen waste is even less well known among the students. Over 50 percent had never heard about composting of garden and kitchen waste. While only slightly over 22 percent knew what it means. This reflects the current lack of composting facilities. Organic waste fractions are normally disposed off together with the rest of household waste.

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ISSN-L = 2285 – 3642
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Surprisingly, the majority of students had heard about incineration and knew what it meant although incineration is currently not used in Romania. Only slightly less than 10 percent claimed to have never heard about incineration.

What was also surprising was the fact that almost 20 percent claimed to have never heard about landfill of waste although it is a widely used technique at the moment. Fewer pupils knew the concept of landfill compared to incineration, kerbside collection services and recycling of paper - although the majority of waste is land filled.

3.2 Importance ascribed to different waste management concepts

The importance of different waste management options had to be rated by the students on a scale from 1 to 10. Table 2 shows the average importance that was ascribed by the pupils from the different groups to the different aspects. The best option according to the waste hierarchy, to "reduce the amount of waste", was rated as being very important. However, "recycle our waste" was even considered slightly more important by Romanian students. They were less inclined to find "re-use of waste" important, "compost organic waste" was rated as being of very low importance although re-use and composting are both possible options to reduce waste. According to the waste hierarchy re-use is seen as being more important than recycling and composting is on the same level as recycling (compare Fig. 1).

Table 2. Importance of waste management options

Concept	*Importance*
Reduce the amount of waste	8.68
Recycle our waste	9.09
Compost organic waste	4.26
Re-use waste	6.21

3.3 Landfill

If students had heard of the concept of landfilling waste, they were asked what they associated with this technique. Landfill is currently seen as the least good option to handle waste according to the waste management hierarchy of the EU and in almost all other western countries. However, Romania still heavily relies on this technique and in the past, waste was often disposed off in small, uncontrolled landfill sites. It was therefore not clear whether pupils might have the feeling that it is an adequate treatment option for household waste.

However, the answers to the question indicate that many students are aware of the negative side-effects of landfill. As can be seen in Table 3, a large amount of answers (45.4 percent) did neither associate positive nor negative aspects with "landfill". They simply associated "waste", "storage of waste" or "where waste goes" with landfill. However, negative associations were also common. 18 percent associated misery, 10.6 percent smell, 5.7 percent environmental pollution and 5 percent disgusting or ugly with it. Moreover, around 2.1 percent thought that is was a problem for human health and 1.4 percent stated that is was "bad". A low number of students also argued for other waste management options instead. 2.8 percent stated that waste could be recycled instead, another 2.8 percent stated that it could be burned instead. Only 1.4 percent stated that landfill was "good". Overall, results show that where Romanian pupils knew the concept of landfilling waste, they rather associate negative aspects with it.

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Table 3. Associations of students with the word landfill

Association	Percent of answers
(Storage of) waste	43.97
Misery	17.73
Smell	10.64
Environmental Pollution	5.67
Disgusting, ugly	4.96
Waste could be recycled instead	2.84
Waste could be burned instead	2.84
Human health	2.13
Bad	1.42
Where waste goes	1.42
A good thing	1.42
Other reasons	4.96

3.4 Incineration

If pupils knew what incineration was, they were asked which impression they had about this technique. The following options were provided: Incineration is

- a good technology for the treatment of waste
- not a good technology for the treatment of waste
- a potentially good technology if certain criteria are met
- I do not know whether it is a good technology

Students were also asked to provide reasons for their judgement. Since incineration is at the moment not used in Romania, it was supposed that approval rates would be rather low. It was of particular importance in these cases whether pupils were able to identify criteria, which might help to increase the usefulness of incineration, e.g. the containment of fumes or the recovery of energy.

The questionnaire revealed that the number of pupils who agree and disagree with incineration as well as the number of students that did not hold any opinion about incineration is almost evenly distributed (around 30 percent), whereas only a small proportion (6.7 percent) of the pupils said that it could be a good option if certain criteria were fulfilled. These students named “the containment of fumes”, “recovery of energy” and “the limitation to materials which cannot be recycled” as criteria. The specific percentages can be seen in Table 4.

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Table 4. Perception about incineration

Impression of incineration	*Percent of answers*
A good technology	28.57
Not a good technology	29.52
A potentially good technology if certain criteria are met	6.67
Do not know whether it is a good technology	27.62
Missing answer	7.62

Given the distribution of answers, it is questionable whether students really understood the concept of incineration. The question might have led to some confusion. In some cases pupils might have believed that the private burning of waste was meant. For instance, one student who approved of incineration stated that "I think every household should burn their waste in the garden". Another student wrote that "we always burn our waste". This possible confusion might also explain why such a large number of students (around 78 percent) said that they had heard about incineration and knew what it meant (Table 1). The private burning of waste is in no way more environmentally friendly than the burning of waste in incineration plants, these answers reflect the limited knowledge regarding air pollutants and residues which might have a negative impact on human health and the environment. Considering this, there seems to be a lack of environmental education regarding the negative effects of private or industrial burning of waste. While incineration can be a relatively safe treatment option for waste if strict emission limits are regarded and energy recovered, incineration cannot be seen as a good treatment option per se. Pupils who said that it is not a good treatment option for waste normally referred to the release of gases, in some cases, these were referred to as "toxic gases" or "greenhouse gases" in particular.

3.5 Recycling

Students were asked to sort different materials into recyclable and non-recyclable materials. The results are shown in Table 5.

Many students were not aware that drink cans and aluminium foil can be recycled. However, the overall rate of materials that were correctly classified as being recyclable was very high.

Table 5: Knowledge about recycling possibility

Materials	*Correct answers [%]*
Paper	81
Glass	82
Fruit juice cartons (Tetra Paks)	90
Plastic bottles (PET bottles)	72
Drink cans	88
Cardboard	64
Aluminium Foil	81

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Overall, 32.4 percent of the Romanian students classified all materials correctly. This high number was surprising, since waste management is currently not very well developed.

3.6 Participation in household waste recycling

Participation in household waste recycling was measured by asking pupils to indicate their frequency of participation on a three-point scale: whenever possible, sometimes and almost never.[2] Three materials were provided in the questionnaire: paper, cans and glass bottles. General trends are summarised in Table 6.

Table 6. Recycling frequency.

	Whenever possible	*Sometimes*	*Almost never*	*Missing answer*
Paper	57.1	13.4	25.7	3.8
Cans	32.4	21.9	40	5.7
Glass bottles	29.5	28.5	39	3

Overall, a large part of the students stated that they recycle “almost never”. Paper was the only one of the named materials which was recycled by 57 percent of the surveyed students. However, even paper was recycled “almost never” by around 26 percent of the asked students, cans were only recycled by 32 percent of the students “whenever possible” while 40 percent did not recycle them. Glass bottles are equally not recycled by almost 40 percent of the students.

If pupils stated that they did not recycle regularly, they were asked to provide reasons for this not recycling. This question was supposed to identify key factors which limit the number of people participating in recycling behaviour.

63 percent of the pupils provided reasons why they did not recycle. These are summarised in Table 7. The majority of pupils stated that it is not possible for them to recycle although it remains unclear why it is not possible. It might either be a lack of space, recycling points or knowledge. Around 13 percent of the questionned students said they were not intersted. The same proportion named the lack of collection points as a reason, followed by a lack of storage space. 6 percent claimed that recycling was too complicated for them and another 6 percent said that their parents did not do it either. Some pupils also claimed that it is polluting, probably referring to the space that is needed in their homes and not to the technique itself. Dislike was also named by some pupils as well as a lack of time. Overall, most students thereby named external factors as reasons (not possible, no collection points, lack of storage space). Individual factors which in some cases reflect a lack of interest, knowlege or wilingness to recycle (not interested, too complicated, because parents do not do it, it’s polluting, dislike, lack of time) also mattered, although they were named less often.

[2] Gamba and Oskamp (1994) found, that self-reported recycling behaviour was higher than observed recycling behaviour. Reported frequencies might be biased by social desirability or selective remembrance. While self-reported behaviour is a common method in social sciences, the frequencies reported in this paper might show a small bias towards higher reporting of recycling frequency.

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Table 7. Reasons for not recycling

Reasons	*Percent of students*
Not possible	46.9
Not interested	13.3
No collection points	13.3
Lack of storage space	10.5
Too complicated	6.0
Because parents do not do it	6.0
It's polluting	4.5
I do not like it	4.5
No time	3.0
Other	12.0

3.7 Importance of waste reduction

Pupils were asked if and why they thought that the amount of household waste should be reduced. The waste hierarchy defines that the best way of dealing with waste is to reduce the amount of waste produced. In accordance with this, the large majority of pupils believed that waste should be reduced. Only one pupil stated that he did not believe that waste should be reduced since he was "not interested". Twelve percent of the pupils left the answer blank. All other pupils named the reasons shown in Table 8 for their belief in a reduction of household waste.

The reason that was named most often was the reduction of environmetnal pollution. Interestingly, the protection of human health was named by over one quarter of the Romanian pupils as a reason to reduce waste. It was thereby the second most often named reason. Reasons such as the protection of nature, the responsibility for future generations and the saving of resources were each named by around 5 percent. Other reasons, such as waste being ugly, water quality and the reduction of global warming were only rarely given.

Table 8: Reasons for waste reduction

Reasons	*Percent of students*
To reduce environmental pollution	29.3
To protect human health	25.7
To protect nature	5.9
Too much waste in the future	4.4
To save resources	4.4
Because its ugly	2.9
Water quality	2.2
To reduce global warming	1.5
Other	3.7

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4. Discussion

This study provided findings on knowledge, attitudes and behavior of Romanian pupils regarding waste management for the first time. Overall, it was found that theoretical knowledge about different waste management concepts is not well developed while in general waste management is considered to be an important topic.

Knowledge was particularly high for waste management options which are currently performed in Romania: Recycling of paper, kerbside collection services and landfill. Composting, which is currently rarely done in Romania, was only known by one fifth of the students. The results in respect to incineration are difficult to interpret since students might have thought that the private burning of waste was meant and not industrial incineration processes. These results for knowledge clearly indicate the need for more teaching of concepts, processes and options, which are currently not performed in Romania. Composting is an environmentally very useful technique since it actively reduces the amount of biodegradable municipal waste which ends on landfill sites. It thereby also reduces the impact that waste has on global warming since biodegradable waste leads to the production of methane, a potent greenhouse gas, if it is put on landfill sites. However, students need to know of such possibilities and of their advantages in order to start participating in such schemes. In particular composting can often be easily carried out at home in the garden or on the balcony. The potential for students to participate is therefore given but knowledge about these options is essential.

Romania currently largely relies on landfill as a waste management option. Accordingly, many students named neutral aspects (e.g. “storage of waste”) when asked about their associations with landfill. Still, a large amount of students reported pronounced negative feelings regarding landfill. This perception is in accordance with the waste hierarchy which also considers landfill as the least best option to treat waste.

Interestingly, knowledge regarding recycling potential was rather high. Students knew which materials could be recycled while at the same time, a large proportion of students did not recycle themselves, primarily since it is “not possible”. It remains unclear, why it is not possible. It might either be a lack of space, collection points or knowledge. However, the theoretical knowledge to recycle is already available. Therefore, students who name a lack of collection points as a reason (or who find recycling “not possible” for external factors) will find it easier to participate in recycling options once they are introduced. The lack of interest, however, which was named by 13.3% of the students has to be addressed through educational initiatives. The benefits of recycling need to be highlighted in front of limited landfill capacity and resource efficiency.

Waste reduction, the best option according to the waste hierarchy, was considered important by most pupils despite the fact that Romania currently only produces little waste per person compared to the EU average. The questionnaire showed that pupils in Romania are aware of the negative consequences for human health and the environment that are associated with landfill. The specific quantity of waste that is produced is therefore probably of less importance compared to the feeling that too much waste is currently land filled.

Incineration was regarded sceptically by about 30 percent of the students. While this can be a problem regarding incineration it only reflects part of the picture: Currently, waste is primarily land filled in Romania and the governments wants to introduce incineration plants in the future to reduce landfill, as has been

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done in many other European countries. A safe use of the technology can help to increase the environmental performance through a reduction of landfill unless the technology is arbitrarily used. If materials can be (easily) recycled, they should not get incinerated. If the Romanian government proceeds with its plans to establish incineration as a treatment option for large amounts of waste, there has to be acceptance within society. In the current questionnaire, around 30 percent of the questioned students do not show such acceptance but rather see incineration as a source of gaseous emissions that can have a negative impact on human health and the environment. In this area, distinguished information is vital to help the long-term goals of waste management.

5. Conclusion

In this study, knowledge, attitudes and behaviour with respect to waste management were analysed for the first time among Romanian pupils.

In general it was found that the waste hierarchy is only partly agreed with by the students that were surveyed. While landfill was not seen as a good option to treat waste and incineration was equally viewed with skepticism by a large fraction of the surveyed students, recycling was seen as much more important than waste-reduction, waste re-use or composting.

Environmental education needs to address these issues by providing reasons for why the current waste hierarchy is environmentally the best approach. This should be addressed at school in particular. Life-science teachers have the ability and knowledge to provide detailed information about life-cycle assessments of different waste management options. Equally, the social and economical impact of different waste management options should be addressed at school.

While environmental education can help to improve waste management, the questionnaire also showed that it is essential that convenient options for separate collection are introduced. Only if legislators provide bring-banks and kerbside collection services in all areas of Romania will this knowledge be translated into actual good recycling/composting behaviour.

6. Acknowledgements

I would like to thank Oliver Klein, Pera Manacha and Dana Ponata for contributing valuable information. I would also like to thank the Professor-Rhein Foundation, Germany, who partly funded this research.

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