

# Korthagen's ALACT model: Application and modification in the science project "Kolumbus-Kids"

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**Abstract.** In order to improve one's teaching in the long run, reflection on the lessons makes up an integral part in the process of developing a sufficient reflection competence. The problem, however, is how this reflection competence can be established in student teachers already and if that concept is compatible with current systems of teacher education at all. One technique of reflection stems from Fred Korthagen's research, suggesting that colleagues should help evaluate each other's lessons. After having held the lesson, the teacher is asked to look back at it, realising important aspects from a distanced point of view and drawing conclusions for further teaching. It should also be thought about alternatives. While theoretical input on reflection is given in the first part of the article, the second half focuses on the adaptation of Korthagen's approach for the tutoring project "Kolumbus-Kids". The project very successfully implements the ALACT model (action - looking back - awareness of essential aspects - creating alternative methods of action - trial) in teacher education at university and a checklist provided at the end provides an overview of the extensive set of questions to be used in the reflection process.

**Keywords:** Reflection, action competence, teacher education, Korthagen, ALACT model

## Introduction

Besides planning and giving a lesson, it is of major importance for the development of reflection competence and teaching skills to critically discuss the class given. This is why methods for criteria-led reflection of one's own teaching should be practised. An example would be the discussion of one's teaching with the help of colleagues using the ALACT model (action - looking back - awareness of essential aspects - creating alternative methods of action - trial), which is the main focus of this article. Designing a lesson draft and holding the class accordingly as well as reflecting it afterwards, all require a great amount of didactic competence. Werner Jank and Hilbert Meyer describe these didactic skills as the teacher's ability to critically reflect his lesson and to design it in a creative and goal-oriented way while paying attention to general curricular and institutional conditions (Jank & Meyer, 2005). This set of skills has to be constantly developed throughout one's teaching career, as one cannot act didactically without reflecting didactically (Jank & Meyer, 2005).

That said, the term *reflection competence* has to be differentiated as follows: it describes the ability to connect knowledge of teaching theory and practice and to develop a certain distance to one's acting. A teacher thus has to be able to detect his mistakes and be willing to improve his own game. He furthermore should always try new methods and adapt successfully tested teaching concepts to his learning groups. However, this also requires the ability to identify and deal with different student personalities. In comparison to reflection competence, *action competence* is the skill of designing and giving lessons according to curricular and institutional guidelines. It is therefore indispensable to know a wide range of methods and to have the willingness and ability to fulfil tasks of educating. In this respect it

is important to equip pupils with methods which will help them to organise their learning process more effectively, for example by using learning strategies. Both competences cannot be separated from each other since the critical reflection of one's own teaching helps to rethink individual actions.

In order to understand the necessity of reflection, we will first look at its connection to teaching practice as such before current perceptions of reflection and possible techniques will be presented. The focus will be on the ALACT model developed by Korthagen and how this could probably be implemented in university courses at a larger scale, exemplified by the German science project "Kolumbus-Kids" at Bielefeld University and reactions to the concept after an eight year application.

### Practical utility of reflection and action competence

As stated before, reflection and action competence induce each other. It is not enough to know how to link theory and practice in order to teach pupils subject-specific content anymore. Successful teaching and transfer of knowledge also require the teacher to be equipped with competences in education and methodology. The interplay of theoretical and practical knowledge as well as action competence is illustrated in Figure 1. Prerequisites for successful teaching can be summarised like this: the teacher is expected to acquire a diversified practical knowledge that develops into a general, deep understanding of teaching over time. Therefore the teacher should possess a high degree of action competence and should be able to reflect his actions from a critical distance. Evolving reflection competence is therefore considered a central aspect in the education of student teachers. This is why they are taught to evaluate their own teaching in a criteria-led, precise, and critical way. In order to develop such skills, universities offer practical classes for all courses. By that students are given first insights into school practice from a teacher point of view. Apart from that, students can gain experience in different aspects of planning and giving lessons in programmes like "Kolumbus-Kids". The project was founded at Bielefeld University and promotes scientifically talented pupils. University students have the chance to practise their teaching abilities, for which purpose criteria such as didactic principles (e.g. usage of examples and living objects, action orientation, usage of a variety of methods), interaction between teacher and pupils, use of media or classroom management are taken into consideration.

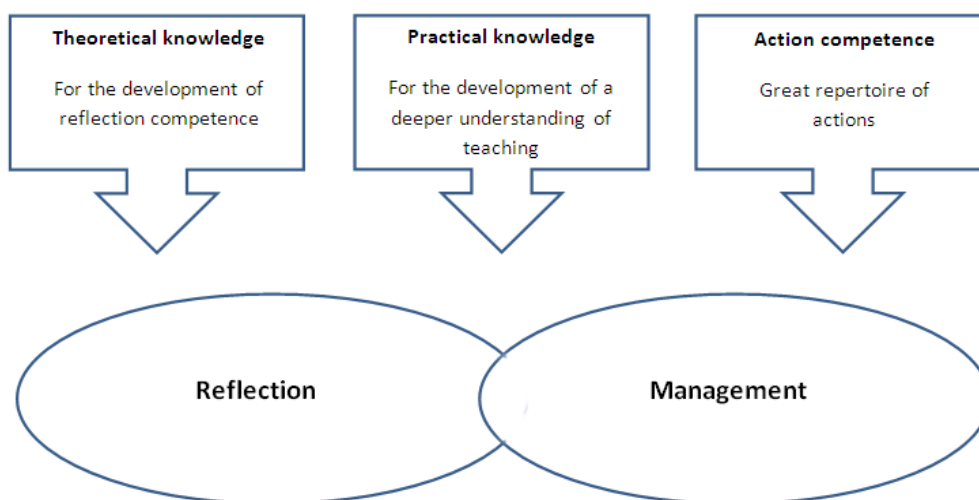


Figure 1. The interconnection of theoretical and practical knowledge and action competence

Yet the criteria the reflection of lessons should follow have to be specified. For this purpose prevailing criteria that are already empirically verified and embedded in theoretical concepts have proven to be suitable, such as the Offer-Benefit model by Andreas Helmke (2003) and the criteria by Hilbert Meyer (2008). It has to be emphasised that there are no exclusively "right" methods for teaching, but still there are some qualities that have met broad agreement. In case of the German federal state North-Rhine Westphalia and its quality analysis, these important characteristics of teaching expertise are (Obst, n.d.)

- Tasks containing problems, relevance for practical application and required level of performance
- Reasonable increase of knowledge
- Motivation and activation of pupils
- Promotion of autonomous learning
- Support of individualised and differentiated learning
- Metacognitive reflection of the learning process and its results by the pupils

Of course those aspects cannot be examined separately, as they cause and influence each other. Autonomous learning can be achieved through the use of open forms of learning, such as *market place learning*. This modern method presents different pieces of information to the pupils at various *stations* which have to be put together afterwards or serve as a way for the pupils to help themselves with the information they really need. By that they are encouraged to learn independently and take action themselves, which motivates and activates them and beyond that promotes individualised and differentiated learning. These effects can be further boosted by considering the learning group's heterogeneous performance when formulating tasks in order to give pupils the chance to work and learn at their own speed. Given that the tasks carry relevance to the pupils' lives, a heightened increase of knowledge will be detectable.

### **Reflection - why is it so important and how can it be done?**

Reflection is utterly important in every teaching process. It can be defined as "the mental process of structuring or restructuring an experience, a problem or existing knowledge or insights" (Korthagen, 1999). Particularly in the last few years, the pressure to introduce reflection at a very early stage in teacher education has increased since parents and politicians, but also teachers themselves are dissatisfied with the systems of teacher education (Korthagen & Kessels, 1999). One of the major problems is the fact that, in teacher training, "theory is presented without much connection to practice" (Korthagen & Kessels, 1999) which claims the need for more practically oriented programmes. This is exactly where the project "Kolumbus-Kids" comes in. Instead of various courses presenting fragmented parts of knowledge, the didactic issue of reflection is tested out immediately in this programme.

Without the ability to reflect, young teachers will ultimately adjust to common practices at their schools and most certainly not follow recent scientific insights into teaching and learning (Korthagen & Kessels, 1999). This was also brought to public attention by a large-scale study carried out at Konstanz University in Germany in which the phenomenon of the *transition shock* (e.g. Muller-Fohrbrodt, Cloetta & Dann, 1978; Dann et al., 1978; Dann, Muller-Fohrbrodt & Cloetta, 1981; Hinsch, 1979) was discussed. As the three main reasons for the transfer problem, Korthagen and Kessels (1999) report *preconceptions*, *feed-forward*

*learning and the nature of the relevant knowledge.* The term preconceptions relates to the circumstance of poor integration of those theories that student teachers heard of in teacher education into their conceptions. Feed-forward learning means that the teacher students will not learn anything if it is not of personal relevance to them. The nature of the relevant knowledge suggests that there is a huge difference between the expert-knowledge student teachers are presented with in teacher education and the action-guiding knowledge that they need in order to make quick decisions in everyday school life (Korthagen & Kessels, 1999). By using reflection as a means of evaluating one's teaching, student teachers are given a chance to reconsider their decisions and connect them to theories they got to know in their educational seminars.

Anyhow, reflection is not an easy task to do. It concerns far more than the cognition involved in teaching as it is additionally based on metacognitive processes like comparison, evaluation and self-direction. Therefore, it can often be found that students are overtaxed with delivering the lesson and at the same time evaluating how it is going. Besides, they lack analytical skills to examine their own practice, including the terminology used talking about their performance and alternatives. Of course, this depends on the particular student teacher to a great extent. Korthagen acknowledges that student teachers generally differ in their learning orientation, e.g. some are internally and others externally oriented (Calderhead, 1989). Students with an internal orientation "viewed learning to teach as a process of self-guided discovery, they could readily look upon their own practice objectively and attempt to evaluate it against a set of criteria of their own choosing" (Calderhead, 1989). On the other hand, externally oriented students "modelled their teaching behaviour upon others, and expected clear guidance from their tutors about how to teach" (Calderhead, 1989).

The question that arises is at what point exactly student teachers should be introduced to the method of reflection. Whereas Goodman (1985) says that student teachers should "build up critical skills and an understanding of the context in which teachers work, well before approaching the teaching task", Russell (1988) suggests that student teachers acquire a basic mastery of classroom practices first before they can focus on reflecting their own work. Russell takes up this position since reflection requires "not only the possession of certain knowledge, critical skills, and a way of conceptualising one's own learning as a reflective process, but also a basic practical competence together with some degree of self-confidence. Particularly at the beginning it is difficult for student teachers to detach from their teaching and reflect on it critically and objectively (Calderhead, 1989). Even though his reasoning seems fairly convincing, the teaching project "Kolumbus-Kids" takes the view that student teachers should practice giving and evaluating their lessons very early on, in their teaching education, so that they are thoroughly prepared for reflection tasks and can independently improve their competences at their future placements at school. Again, this seems a valid position when considering the following: "if reflection promotes pre-service teachers' accountability for their own learning and promotes analysis concerning beliefs of good teaching [...], then novice teachers need to be given the appropriate tools to do both" (Scherff & Singer, 2012).

Reality, however, is rather different. Even though students are expected to teach, videotape and reflect upon a mini-lesson in their field placement, they "often spend the majority of the time observing mentor teachers to better understand how teachers teach" (Scherff & Singer, 2012). This directly contrasts with the proposition that teacher knowledge is based on experiences (Korthagen & Kessels, 1999) and cannot be replaced by observing only.

Instead, reflection can be used to link practice and theory meaningfully. For that reason, it has to be carried out systematically as a new teaching programme at Utrecht University suggests. It is important that student teachers do not only reflect on the basis of questions

asked by their supervisors but rather learn how to do it on their own and together with colleagues. Students in teacher training will not learn simply by experience, "but through reflection on experience and through interaction with others" (Korthagen, Loughran & Russell, 2006). This is why "reflection and intercollegially supported learning are viewed as important cornerstones of practice" (Korthagen, Loughran & Russell, 2006). According to Freudenthal (1978) knowledge can be created best by the learners themselves, a process he calls *guided reinvention*. With regard to teacher education, there are three advantages to consider. First, theory emerging on the basis of reflection has substantially more significance to the student teachers since it results from their own situations. Second, they get used to the process of reflection which makes for an ongoing professional growth and third, student teachers who are used to reflect are also prepared to see a certain theory from a different perspective once it is implemented into their teaching. The latter can even go so far that novice teachers arrive at a point where they want to build a self-directed theory, something that is highly encouraged by teacher educators who should create suitable situations for the student teachers to do so (Korthagen, Loughran & Russell 2006).

So generally speaking, structured reflection can contribute to student teachers creating their own professional knowledge. It has to be emphasised that "the learning of student teachers is only meaningful and powerful when it is embedded in the experience of learning to teach" (Korthagen, Loughran & Russell, 2006) which implies once again the pointlessness of theoretical teaching courses at universities. Even though some teachers might be anxious to share their experiences with colleagues, it is, according to McIntyre and Hagger (1992), exactly that what has to be considered a critical factor in helping teachers to develop classroom practice. The teaching programme at Utrecht University mentioned earlier tries to unite all these ideas with the result that student teachers are trained to use the ALACT model not only for their own teaching but also for the purpose of helping others to reflect on theirs. Those supervision skills are practiced in groups of three university students who meet on a regular basis. Moreover, the students have to write short reports with focussing on discussion content as well as their process of peer-supported learning. Every two weeks then, meetings in larger groups are held where also the teacher educators are present. Feedback from the students suggests that they actually enjoy sharing their problems and experiences with people at the same level. Another advantage for the teacher educators themselves is the saving of time since fellow students can become valuable supervisors as well. (Korthagen, Loughran & Russell, 2006). The reflection procedures in the project "Kolumbus-Kids" were adapted on the basis of the model at Utrecht University and modified with regard to the situation in Germany and will be the focus later on in the article.

## Guideline for the reflection process

As to having stressed the necessity of reflective teaching in the previous part, a practical implementation through the ALACT model of reflection (Figure 2) by Fred Korthagen (1985; 1988) will be presented next. This reflection approach is divided into five steps and consists of *action*, *looking back*, *awareness of essential aspects*, *creating alternative methods of action* and *trial* (Korthagen & Kessels, 1999). *Action* means the teacher realises that something is not right in his teaching. During supervision, the step of *looking back* is fulfilled when the action is relived and looked at in retrospect. Reconsidering one's action and judging the consequences is part of the step *awareness of essential aspects*. In the penultimate step, the teacher thinks about alternatives that would have been appropriate in that situation and puts that alternative into practice afterwards. Since the *trial* phase is another action to be reflected on thereafter, *trial* and *action* are considered one phase and make for a self-coherent

reflection circle. Korthagen (1999) also stresses the opportunity of developing interpersonal skills by the means of reflection. In the end, a teacher's reflection competence should be at a level where no supervisor is needed anymore for effective reflection. Once this aim is reached, this can be called *growth competency*. However, teacher educators realise various problems that inhibit the development of that particular competency. They say student teachers expect to be told what went right and wrong, plus a model solution, tips and guidelines for the next time which means they are externally oriented to a great extent. For them to become independent in the reflection process, they have to analyse the problem in depth before coming up with a proper solution. And that is not all; they should actually opt for a whole repertoire of approaches that might be useful for their future teaching. It is also criticised that student teachers are too self-centred and only secondarily focus on the pupils and their behaviour. A practical problem is the little continuity in the learning process of student teachers (Korthagen, 1999). Only certain points are focused on unregularly and one has to admit that this is also the case in the project "Kolumbus-Kids" since there is just not enough time to consider every reflection aspect thoroughly.

With regard to teacher education practices, the ALACT model is difficult to implement due to large cohort groups. The method was developed to enable supervision among the student teachers themselves, also called inter-collegially supported learning. Based on that purpose, the reflection process would be structured into a series of question and promote a reflection discussion between three to four student teachers. For the procedure to work in real life a "frequent alternation of school teaching days and meetings at the teacher education institute" are required (Korthagen & Kessels, 1999). On another level even, the teacher educators and cooperating teachers have to be reflective themselves with regard to their supervision practices (Korthagen & Kessels, 1999).

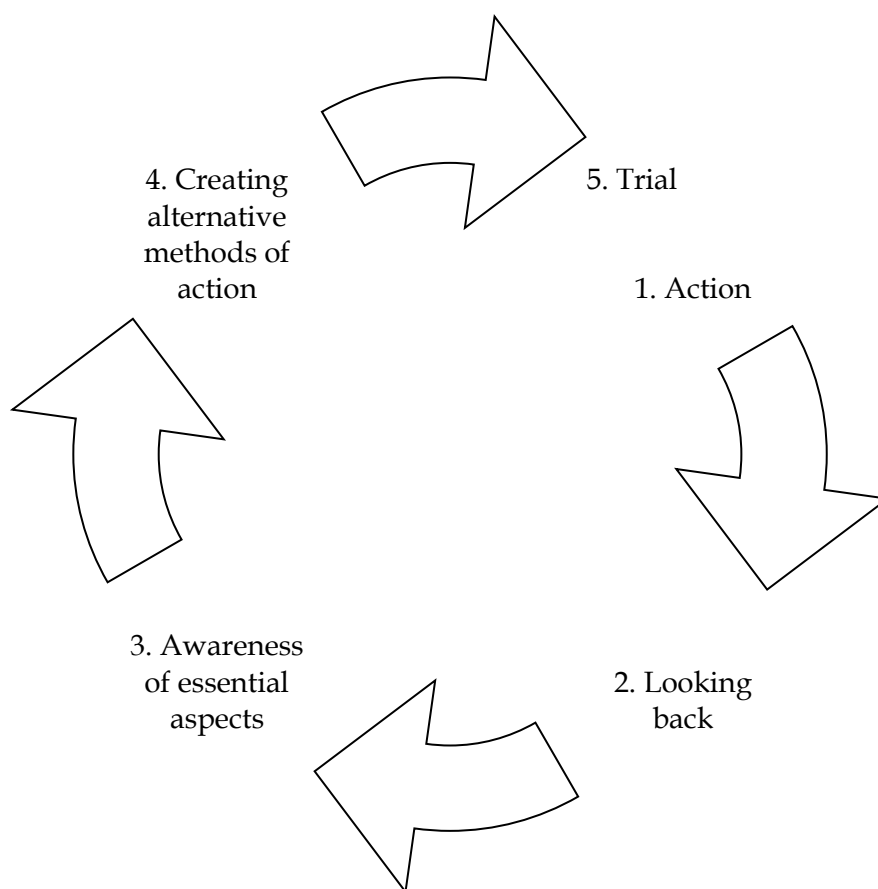


Figure 2. ALACT model (based on Korthagen 1985/1988; Korthagen & Kessels 1999)

## Reflection in the project "Kolumbus-Kids"

The project "Kolumbus-Kids", founded in 2006, provides student teachers with the possibility to gain first teaching experience with small groups of about 15 pupils. Those pupils stand out due to their heightened interest in natural-scientific subjects and their talent in the field of biology, which induces increased activity during the lessons. Up to now, this project is a unique concept in that respect that the Department of Biology Didactics provides extra support of pupils with a special talent in natural sciences. Since university students are rarely trained in using reflection as a means of developing their teaching competence, the staff of the Department of Didactics of Biology at Bielefeld University designed a Reflection-Wiki which aims at supporting student teachers' skills of self-reflection. A great advantage is the fact that they hold the ability to improve their teaching even before joining the official teacher training programme. In a theoretical seminar that they have to attend before being admitted to the practical course phase the students also learn about teaching methodology and diagnostics for gifted pupils. Further, they plan and give weekly lessons in the seminar as a preparation for the project lessons with pupils. The project offers a great opportunity to teach and hold lessons even though the student teachers are not placed at a proper school yet (Wegner & Grotjohann, 2010; Borgmann & Wegner, 2011; Wegner, Minnaert & Strehlke, 2013) which is especially valuable since the length of practicals during university studies and the official teacher training are constantly shortened. For further information on the project please visit its homepage [www.Kolumbus-Kids.de](http://www.Kolumbus-Kids.de).

The Reflection-Wiki is used by the students to analyse their previous lesson held for the gifted pupils participating in the project on the basis of certain criteria. They should reflect on whether they achieved their intended objectives and think about alternatives that they could employ the next time. Every comment and thought on the student's teaching is noted down so that for the next session, it only takes a look to recall the suggested improvements. Thanks to the Wiki, the students do not reflect in a completely unorganised manner – they can evaluate their teaching behaviour under consideration of different categories such as gestures or authority. In order to make reflection as thorough as possible, the "Kolumbus-Kids" sessions are videotaped so they can see the direct realisation of their lesson planning and thus optimise teaching. Since its introduction back in 2009, the feedback on taping the lessons has been extremely positive. At first students might be insecure and nervous, but once they concentrate on the lesson they do not even notice the camera anymore and when they watch the footage in the reflection session with their supervisor they are amazed at seeing how many actions went unnoticed. After regular consultation with the teacher educators at the local teaching training centre it became apparent that those students having undergone video reflection in their studies already are much better prepared when this comes up again during teacher training. They have a considerable advantage in improving their capabilities and conduct of the lessons. Further, the abilities to self-reflect one's teaching and to modify one's teaching skills add profound safety to initial teaching experiences at school. Students who participated in the project already know how to deal with lesson interruptions practically and might have found that reactions always depend on the precise situation.

Before reflection comes into effect, however, the student teachers have to plan a proper teaching unit on a topic spanning up to five double-period lessons. On the basis of consulting phases and written feedback, the lesson designs are supervised by the project manager and the students are introduced to the Reflection-Wiki online for the first time. A short guide provides them with the essential background knowledge on self-reflection before they have to think themselves back into pupil perspective. This exercise helps them to reflect on their own attitude towards teaching and takes into consideration their personality

and characteristics which will influence their teacher role. After that the student teachers are informed about the teaching categories that they will deal with throughout their future reflections. Only two are chosen to focus on in the first double lesson. The selection of categories ranges from language, interaction, classroom management, body language and organisation to media and each implies additional sub-categories. To help the students understand what is meant by the terms, there are both explanations and short video clips representing good and bad realisations.

During the conducting phase, special emphasis is put on employing experiments, observing living animals, using new technologies and implementing a variety of teaching methods when dealing with around 15 pupils between the ages nine and twelve. Since the students are still in their studies and cannot be expected to hold a lesson perfectly, they are supported by a trained supervisor who observes the student's teaching practice and intervenes if necessary. Filming takes place in three of the five double-lessons for around ten minutes each.

After teaching, the student teacher meets with the supervisor for a reflection session. First, a more general impression regarding the lesson's course and the teacher's behaviour is discussed. All the details are noted down in an online evaluation sheet using a scale from 1 to 6 (1 = very weak, 6 = perfect). It helps the student teachers to get a feeling of judging their own performance. Throughout the following in-depth reflection, the supervisor points towards certain issues that might have gone unnoticed by the student teacher. Still, it is very important to have the student teacher summarise all the findings and critical observations at the end. At home, and with a certain distance to the teaching action itself, the student teacher watches the short video clip and reflects on it autonomously, aided by the already well-known reflection categories. The purpose of this second step of reflection is to see whether there are differences between the spontaneous reflection directly after the lesson and this more critical, methodological evaluation after having watched the video. By watching the video sequence, the student teacher will come to understand the supervisor's critique and view the teaching from a more objective perspective. Any possible improvements of the teaching are noted down in the Wiki. All the findings of the reflection process are saved via the Wiki's backup feature and can be gone back to at any time.

The categories talked about in the previous parts that are used to support the reflection process criteria-led will be described in more detail in the following. They also have been transferred into a check list that might be used to get to know this reflection method better (see Appendix).

## **Criteria of reflection in the project "Kolumbus-Kids"**

### ***Prerequisites***

*Characteristics of the learning group:* The composition of the group is outstanding with regard to the pupils' interest and talent in natural-scientific subjects. The different courses consist of pupils of the same grade, aged 10 to 13 or 16 to 17 respectively.

*Room equipment:* In order to allow for effective scientific working, different rooms are available. A laboratory, spacious work-tables, media equipment (including a Smart Board) and laptops as well as terrariums with real animals provide ideal conditions for teaching and learning.

*Prior knowledge:* The selected pupils have already acquired basic knowledge in private and school contexts.



*Marginal conditions:* The lessons are also affected by outside influences that have to be taken into consideration when planning them. Examples are the weather in case of field trips or the noise level in the building.

*Time of the lesson:* The lessons do not start until 4.30 p.m. and the pupils might have had a long school day already. This is the reason why the motivation and the willingness to learn may be partly impaired.

### **Didactic principles**

*Exemplary and original content:* The topics should not only be conveyed theoretically, but also practically. This includes the authentic encounter with living animals or independent experimentation. Also, references to current affairs from the media should be made.

*Pupil orientation:* It is important not to expect the pupils to know as much as the teacher. The pupils' individuality should be considered and integrated into the lesson, as every pupil has different abilities and interests. This again brings along both advantages and disadvantages, which should be dissolved by overlapping content. Even if some pupils are not interested in a particular topic, the teacher should try to motivate them by the use of current issues or hands-on phases.

*Action orientation:* It has been scientifically proven that effective learning takes place when action is emphasised (Spörhase-Eichmann, 2004), which means integral and actively. Cognitive, affective and psychomotoric components are to be united in the learning process. Abstract knowledge should be deduced from concrete or well-known phenomena (common knowledge) and examples.

*Relevance and topicality:* As the topics dealt with in the project are independent from the school curriculum, they should be relevant to the pupils in order to draw their interest. This will result in active participation on part of the pupils and improve the teaching experience for the trainee.

### **Didactic construction**

*Articulation and openness of learning:* Articulation means that learning should be clearly structured right from the beginning of the lesson. The main topic should be perceptible for the pupils at any time. Openness, on the other hand, implies that the pupils can influence their way of learning as long as their interests are compatible with the predetermined topic.

*Choice and variety of methods:* The choice of a suitable method is of major importance for increasing the pupils' activity. While classes used to be mostly teacher-centred years ago, nowadays teachers use a wide range of methods like group work, learning games and different types of interaction in order to motivate their pupils. However, despite using a variety of methods, one should not lose track of the essential content.

*Cogency and thought process:* The pupils should be able to clearly identify single teaching phases and understand their logical construction so that they can follow the teacher's train of thought without problems. In order to check the phases for their transparency it is advisable to have the pupils summarise the content at the end of a lesson every now and then.

*Natural-scientific approach:* With regard to biology the lessons should deal with scientific, subject-specific topics, which also include methodical processes like pipetting, starting a serial dilution or documenting an experiment observation. However, types of interaction do not belong to this category. When planning a lesson the choice of method is also decisive

with regard to the natural-scientific approach. Did a certain method aid understanding on the part of the pupils?

*Setting of priorities:* Every lesson should have a main topic, whose importance should be clear for every pupil. This is conjoined with the lesson's cogency, which is important for understanding the essence of the topic. The goal of the lesson should therefore be stated by the teacher as precisely as possible at the beginning.

### **Media**

*Suitability, content and degree of abstraction:* If media are used to support the teaching, they have to be used in an appropriate way and should not be telling too much (e.g. do not use overlong movie scenes). Every media has a degree of abstraction, which should be considered with regard to the age of the class.

*Design and originality:* The media should be appropriate and original. Also, their use should be varied without relying on the same media every lesson.

*Integration and usage:* Media can be used at various stages of a lesson, for example at the beginning or end of a topic. Most pupils are very experienced when it comes to using the Internet and other electronic sources. This will help them finding the information they are looking for. Although the impact of new media has risen, the pupils need to be made aware of the fact that not all electronic media communicate correct contents, and should therefore be treated with caution.

*Technical handling:* A successful integration of media also requires a certain kind of media competence on the part of the teacher. Therefore, the teacher should make himself familiar with the technical equipment before actually using it in class.

*Choice and economy:* Since technological possibilities are increasing by the day, it is important to think about which media suits the lesson best and to not overload the lesson media-wise.

### **Introduction**

*Meaningful context:* The introduction to the lesson has to make the pupils understand the importance and meaning of the respective topic. In reference to the lesson's didactic construction the teacher should emphasise what the pupils have to expect in this lesson.

*Motivation:* Particularly in a new learning group it is the introduction of a lesson that is crucial to promote the pupils' motivation and interest.

*Question- or problem-orientation:* A lesson can be introduced by raising a question or a problem, which will be solved by the end of the lesson.

*Methodology:* The introduction can be done in several ways, e.g. by showing a film, conducting a demonstration experiment or relating the topic to an everyday problem.

*Linkage to previous lessons:* Depending on the position the lesson has in the teaching unit, the teacher should draw a connection to the previous lesson by completing a topic or settling a question.

### **Organisation**

*Group management:* If group work is part of the lesson, the teacher must think about the group management beforehand in order to avoid having the same pupils working together all the time. Depending on the situation, however, it might be convenient to arrange the

groups rather spontaneously. Methodical games can help to form varied groups. Anyway, the teacher should also consider the time limits as well as problematic group constellations.

*Allocation of responsibilities:* This means the delegation of certain tasks to the pupils, which they will then carry out independently. Group moderations, for example, can be led by pupils very successfully, which, in turn, strengthens their self-confidence and trust in their own abilities. Still, it is the teacher's task to continuously check whether the assignments have been taken seriously.

*Collection of results:* Especially in the natural sciences results of experiments should be presented in an appealing way, so that the pupils will fully comprehend the importance of the experiment. Results can be displayed on the board, as a presentation including a poster or as an oral presentation by either a pupil or the teacher.

*Independence of the pupils:* Pupils learn more effectively if they are active themselves and work independently. Therefore it is inevitable to have phases of independent, action-oriented work in order to increase the pupils' motivation. This can also be done by varied usage of methods.

*Time management:* Most lessons are 45 minutes long, but some schools have already implemented 60 or 90 minute lessons. In order to not run out of time or to finish early, the teacher has to manage time right. He should guarantee a high proportion of quality learning time, consolidation of results and an ideal use of the entire lesson. It is therefore advisable to have a didactic reserve at hand, which is also beneficial to motivate the pupils in short phases of relaxation.

## **Interaction**

*Relationship with pupils and respect:* A kind and respectful tone is the basis for a pleasant class and teaching atmosphere. However, this depends on the teacher's personality (open/reserved) to a great extent. Whereas the teacher is well allowed to show a rather reserved behaviour when teaching a new class, he should generally opt for a middle course of trust and distance towards the pupils.

*With-it-ness and humour:* With-it-ness means the teacher's ability to know what goes on inside the pupils, which requires a high degree of empathy. Since positive emotions makes for more successful learning, the teacher should not be too serious throughout the lessons. A bit of humour will contribute to an enjoyable atmosphere and strengthen the relationship with the pupils. Still, the teacher should act both respectfully and humorously, otherwise he might not be taken seriously.

*Dealing with disturbances:* It is important that the teacher consistently takes action against interruptions, which also implies that he himself has to adhere to the rules. Otherwise, the relationship with the pupils and their respect will be affected negatively.

*Acceptance of teacher role:* The teacher needs to feel comfortable in his role and should be perceived and accepted as a person of authority by the pupils. This feeling will be achieved if the teacher is prepared properly and shows certainty in subject-specific contexts. Particularly young teachers should refrain from being too close with the pupils.

*Personal presence and reliability:* The teacher should be present at any time, even in working phases where he is not the focus of the pupils' attention. Further, the teacher's statements should be binding; he himself has to adhere to rules and either impose them consistently or clearly retract them.

## **Classroom management**

*Subject-orientation vs. method-orientation:* Whereas subject-oriented lessons focus on conveying general knowledge, method-oriented lessons are more about emphasising scientific methods and paths to knowledge.

*Reaction to utterances by pupils:* Calling up a pupil requires listening to and dealing with the utterance. Depending on the level of disturbance, attention can also be paid to unrelated utterances. The teacher's moderation competence is very important in this regard; he may use *whole-reinforcers* ("absolutely right", "super", ...) in order to motivate the pupils or *part-reinforcers* ("right direction", "just about", ...), which imply that parts of their answer were correct. *Echos* (word for word repetition of a pupil's utterance) by the teacher should be avoided, as they diminish the pupil's answer. Rather, the pupil himself or a classmate can be asked to repeat what has been said.

*Restricted or loose leadership:* A restricted leadership is reflected in a lesson going strictly according to the teacher's plan, as he steers the lesson into the right direction. In a lesson characterised by a loose leadership, the pupils have far more chances to influence the structure of the lesson.

*Conversation techniques:* Classroom conversations can be organised in various ways. Whether they are successful or not depends on the techniques the teacher employs. Besides the common Teacher-Student-Talk there are many other types of interaction to consider.

## **Variation**

*Reasons for changing the plan:* Depending on the situation, a teacher might have to deviate from his lesson plan spontaneously, which has to be explained to the observing colleague afterwards. Appropriate deviations are very important and mark a good teacher.

*Justification of alternatives:* Alternations to the original lesson plan have to be made up and thought through in no time. This means the teacher has to be highly spontaneous. If chosen well, such alternations can make lessons more vivid though.

*Alternative approach:* In order to motivate the pupils for a new topic, a surprising approach should be used, for example visiting a science centre. It also means that in case something that was planned did not work out during the lesson, alternative approaches for these phases have to be addressed afterwards.

*Consequences:* Pupils must know disturbances and disobedience are followed by consequences. This is especially important when working with dangerous chemicals and the like to make the pupils respect the rules. In order to be respected by the pupils, the cogency of the teacher's behaviour and actions and his way of dealing with disturbances are equally important.

## **Joker**

*Innovation:* Innovative ideas are not only fascinating in technology, but also very useful for the daily teaching routine. The pupils are able to discover something new; however, this requires a certain interest in current research and more preparation on the teacher's part.

*Safety:* Especially in the sciences it is very important to follow safety guidelines when conducting experiments.

*Subject-specific correctness:* A teacher always has to be prepared with regard to the subject-specific content he is about to teach.

### **Meta level**

*Disturbing factors:* At the end of the lesson both the teacher and the observing colleague should address negative aspects.

*Gain:* The teacher should name topics that he wanted the pupils to know about at the end of the lesson. The observer then discusses whether the lesson goal was achieved.

*Possible changes:* Aspects the teacher was not pleased with should be noted down in order to avoid making the same mistakes again.

*Conduct:* At this point the interaction between the teacher and his colleagues throughout the lesson observation and discussion are evaluated.

### **Conclusion**

In order to teach efficiently and to constantly evolve in one's ability and skills, it is inevitable to undergo the process of reflection. This, however, requires the development of *reflection competence*, which in turn influences a teacher's *action competence* as well. Current teacher education programmes often struggle with preparing future teachers sufficiently for practice at school where they are often on their own and have difficulties in improving their teaching. Thus, the transition shock from university to school environment makes many novice teachers doubt their abilities and they are certainly overwhelmed facing teaching reality without sufficient support. If the appropriate methods and procedures are made available to student teachers already, these effects will be minimised tremendously. Because of that, teaching programmes at university level should counteract the undesired development by providing students with the knowledge and expertise needed for useful reflection. One way to do that is to introduce the ALACT model (action - looking back - awareness of essential aspects - creating alternative methods of action - trial) by Korthagen in practical teaching courses as it is the case with the project "Kolumbus-Kids". The model suggests peer-supported learning, meaning reflection in small groups of students. This is considered in the project on a smaller scale since the student teacher evaluates his lesson with a supervisor only.

Nevertheless, it is a very good practice for being able to reflect one's teaching skills individually if there is no one around to observe the lesson in professional life later on. The criteria the reflection process can follow have been described in detail throughout this article. They are discussed after the lesson and should be considered when coming up with alternatives for certain parts of the lesson. As reflection is a process that also contributes to the overall school development, it is important to emphasise the necessity of establishing reflection competence in young teachers already and to send them off from university to their schools with the ability to improve their lessons continually.

This is why the project "Kolumbus-Kids" makes an important contribution to the professional development of teachers and could serve as a model for similar projects in teacher training. Even though it cannot be expected to have projects like that at every university, lecturers and teacher educators should consider implementing features of reflection as a valuable tool in their didactic courses, maybe even on the basis of the checklist used in the "Kolumbus-Kids" project. Also any pre- or even in-service teachers might find this overview of evaluation criteria interesting and helpful to work on their teaching.

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## Appendix: Check list for the reflection of one's own teaching

In the following a check list for the reflection of teaching will be presented (Table 1). It helps to get an overview of the preceding detailed list that can be employed on one's own lesson. Although some aspects might only be the case for the project "Kolumbus-Kids", this check list can serve as a basis and be adjusted individually.

**Table 1. Check list for reflection of lessons in the project "Kolumbus-Kids", based on Korthagen's ALACT model**

Teaching Criterion	Questions	Answer	
		Yes	No
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>• Was the group organisation paid attention to?</li> <li>• Was the room equipment made use of in order to teach the content?</li> <li>• Was the teacher well versed in dealing with the equipment?</li> <li>• Was the content related to the previous knowledge of the pupils?</li> <li>• Did the lesson build upon previous knowledge?</li> <li>• Were marginal conditions taken into account?</li> <li>• Was the fact that the pupils might be less motivated in the afternoon considered?</li> </ul>		
<b>Didactic principles</b>	<ul style="list-style-type: none"> <li>• Were examples with real objects or animals incorporated?</li> <li>• Was the individuality of the pupils paid attention to?</li> <li>• Did the pupils get the chance to influence the structure of the lesson?</li> <li>• Was the lesson action-oriented?</li> <li>• Were abstract principles deduced from well-known phenomena?</li> <li>• Did the topic relate to current events?</li> <li>• Were the pupils able to understand the topicality and relevance of the content?</li> </ul>		
<b>Didactic construction</b>	<ul style="list-style-type: none"> <li>• Were the learning ways open or structured?</li> <li>• Which methods were used?</li> <li>• Was it too much or too little variety?</li> <li>• Was there a compelling lesson plan?</li> <li>• Were natural-scientific aspects employed in the lesson?</li> <li>• What was the focus of the lesson?</li> </ul>		
<b>Media</b>	<ul style="list-style-type: none"> <li>• Was the use of media appropriate?</li> <li>• How was the media arranged?</li> <li>• How was the media employed?</li> <li>• Was the teacher's media competence sufficient?</li> <li>• Did the teacher choose appropriate media?</li> <li>• How many different media were employed?</li> </ul>		
<b>Introduction</b>	<ul style="list-style-type: none"> <li>• Was the introduction designed in a way that the pupils knew what the topic was about?</li> <li>• Did the introduction increase the pupils' motivation?</li> <li>• Was a problem or question raised in the beginning?</li> <li>• Which method was used for the introduction?</li> <li>• Was the introduction linked to content of the preceding lesson?</li> <li>• Maybe: Was the introduction appropriate time-wise?</li> </ul>		

<b>Organisation</b>	<ul style="list-style-type: none"> <li>• How were the groups organised?</li> <li>• Which tasks were assigned to the pupils?</li> <li>• How were the results collected?</li> <li>• When was it possible for the pupils to become active during the lesson?</li> <li>• Was the amount of time spent on the individual teaching phases thought through?</li> </ul>
<b>Interaction</b>	<ul style="list-style-type: none"> <li>• How is the relationship with the pupils – respectful and friendly?</li> <li>• Were With-it-ness and humour present?</li> <li>• How did the teacher deal with disturbances?</li> <li>• Was the teacher accepted as such by the pupils?</li> <li>• Was the teacher personally present all the time?</li> <li>• Were the teacher’s statements binding?</li> </ul>
<b>Classroom management</b>	<ul style="list-style-type: none"> <li>• Was the lesson conducted subject-oriented or method-oriented?</li> <li>• How did the teacher react to utterances by pupils?</li> <li>• Was the lesson led in a restricted or loose way?</li> <li>• How was the Teacher-Student-Talk held?</li> </ul>
<b>Variation</b>	<ul style="list-style-type: none"> <li>• Were there deviances from the lesson plan? Why?</li> <li>• Why did the teacher choose this alternative?</li> <li>• Were alternative approaches chosen?</li> <li>• Which consequences did the alternatives have?</li> </ul>
<b>Joker</b>	<ul style="list-style-type: none"> <li>• Was the lesson innovative?</li> <li>• Was safety ensured throughout the lesson?</li> <li>• Was the lesson correct in subject-specific terms?</li> </ul>
<b>Meta level</b>	<ul style="list-style-type: none"> <li>• What did we not like?</li> <li>• What was the gain?</li> <li>• What do we want to maintain or change?</li> <li>• How do we interact with each other?</li> </ul>

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