CHAPTER 3
THE PLACE AND MEANING OF REDUCING THE LEARNING MATERIAL IN THE LESSON STRUCTURE

3.1 INTRODUCTION

If the teacher wants to acquire more purposefulness, be more scientific and more certain in his teaching and not act fortuitously, he must be able to give didactically accountable reasons for the construction of each phase of his lesson structure without falling into a fixed pattern or following recipes. From this it is clear that it is only the thoroughly prepared teacher who can, on the basis of his greater knowledge and better skills, give an account about *what* he is going to do, *why* and *how*. The didactic categories give certainty to the *what*, the lesson and learning aim, to the *why*, as well as to the basic forms and methods that he (the teacher) uses to attain the aim, the *how*. Corresponding to the teaching aim striven for in the didactic design, provision must be made for teaching and learning modes that direct and bring into motion the activities of the pupils. A clear delimitation of the lesson aim (teaching aim) is the first step that must precede designing an accountable lesson structure and only then can the teacher anticipate a particular course of the lesson.

In constructing a lesson structure, there are especially two aspects that require thorough investigation and interpretation, namely, the teaching aim (lesson and learning aim) and the phases of the course of the lesson. Below is an attempt to connect the place and meaning of *reducing the learning material* to the teaching aim and then to indicate its place and meaning in each phase of the course of the lesson.

The matters of reducing the learning material and the lesson structure differentiate themselves into two primary moments and each will be explicated fully. This has to do, on the one hand, with the *preparation* by the teacher, delimiting the lesson aim out of the learning aim as taken up in the syllabus and, on the other hand, with the *anticipated* course of the lesson and the place and meaning of the reduction of learning material in each phase of the event.

3.2 THE TEACHING AIM AND REDUCING THE LEARNING MATERIAL

3.2.1 General

In school practice as well as in some teacher training institutions there is a separation between a direct and an indirect aim or between a teaching and an educative aim. On the one hand, the teaching aim has to do with instilling knowledge, skills and proficiencies and, on the other hand, the educative aim has to do with guiding, intervening and providing assistance by the teacher on the basis of *norms* and values. The *teaching aim* has to do primarily with contents and the *educative aim* with the moral aspect. Such a separation, instead of a distinction, necessarily influences one-sidedly the interaction and harmony between the teaching aim as an objective moment and the educative aim as a subjective moment.

Along with the actualization of each teaching aim there is an eye to bringing about change in the child. This change implies not only a knowing or intellectual change but also a change in disposition, in other words a change in the child as a totality.

3.2.2 The teaching aim and the "what" of teaching

To try to realize a particular teaching aim the teacher must design a situation in which he is going to unlock *something* (content) for the child. Proceeding from the prescribed contents the teacher is going to search further for a lesson form with which he intends to attain optimal formative value. Although form is the constant factor in the original everyday life world, this is different in the planning structure. The contents, as prescribed in the syllabus, are set as is the class for whom it must be offered. Therefore, in the lesson planning there must be a search for a lesson form and method that will maximally unlock the prescribed content. Unlocking reality only is done justice when there is mention of a double unlocking. This double unlocking means, on the one hand, that reality is unlocked for the child and, on the other hand, that the child and his potentialities, and indirectly himself, are thrown open for reality.

Regarding this, Van der Stoep[28] says: "Forming takes shape in the life of a child on the basis of the fact that he throws himself open for reality (subjective moment) but also that reality is thrown open for him (material or objective moment).

In other words, if reality is unlocked for the child, he must respond to the appeal directed to him by both the form and the contents. By answering the appeal, i.e., by acting, the child shows himself in reality. Thus, it is part of the lesson aim for the child to enter reality as far as he can. This entering reality is important in the sense that the child is going to discover his own potentialities under the imperative of the situation. On the basis of the self-discovery of his potentialities it can be expected that he is going to change. Because this changing always implies a total changing, the separation between the subjective and objective moments of the teaching aim no longer is accepted. From the appeal of the form as well as content the child is stimulated and he wants to learn.

About this Mommers[29] says: "Forming is categorical forming in the double sense that a person unlocks reality for himself and by this he opens himself for reality, and categorical insights, experiences and lived experiences come about."

In the event of double unlocking, therefore, there never can be a separation between the educative aim and the teaching aim because the sense of teaching is in educating and educating is actualized only in teaching.

To attain his lesson aim the teacher must unlock something (content) for the child. At the same time, the essential of the lesson contents now become the *learning aim* of the child. Only if the teacher delimits and refines for himself the teaching aim can he plan a situation in which he, in his *representation* of reality, unlocks the essences for the child.

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[28] Van der Stoep, F., *Didaktiese grondvorme*, p. 17c.
[29] Mommers, C., *De plaats en de betekenis van het exemplarische onderwijs in de didactiek*, p. 40a.

For the sake of greater clarity the teaching aim is described in greater detail.

3.2.3 Important aspects of the teaching aim

Since here we have to do with a basic aspect of the lesson structure, it is important to be clear about the specific concepts and their meaningful relationships. For the sake of greater clarity and surveyability, *five* aspects are mentioned and then discussed briefly.

- The syllabus theme (its formative quality) and reducing the learning material.
- The lesson aim and reducing the learning material.
- The learning aim and reducing the learning material.
- Formulating the problem and reducing the learning material.
- The choice of example(s) and reducing the learning material.

There is a brief attempt to indicate the place and meaning of these various aspects for practice.

a) *The syllabus theme (its formative quality) and reducing the learning material*
We find a unique situation in school practice, namely that certain contents are taken up as givens in the syllabus. Consequently, the teacher is compelled to begin his planning from and around these themes. Reality, or, more closely viewed, *cultural contents* are already evaluated and certain facets of them are taken up and organized by the syllabus compilers. Today, as a result of the tremendous expansion of knowledge and research it no longer is possible to offer everything to a child; hence, syllabus compilers are forced to make choices from a number of possibilities. Therefore, the teacher must accept that each theme taken up in the syllabus has formative quality. In other words, there already was a *first or earlier reduction* by the syllabus compilers on the basis of which their choice of the theme is justified. In this regard, Gartner[30] says, "one does not indiscriminately incorporate scientific results into the school curriculum."

[30] Gartner, F., *Planung und Gestaltung des Unterrichts*, p. 242a.

With the compilation of the syllabus there already was a thinking through of the "what" of teaching from which the essence or formative quality of a certain matter has become evident.

b) *Lesson aim and reducing the learning material*
From the reduction of the theme to its essence by the teacher and his interpretation of the learning aim that has become visible he now can proceed to try, in his preparation, to give form to the lesson aim. The lesson aim embodies the form and *ways* on which his planning is going to rest and gives an idea of how he intends to attain the learning aim.

The first task of the teacher as someone who knows and commands his subject is to interpret the learning aim. To do this, it is necessary that he reduce, for himself, the theme as taken up in the syllabus, to its essentials. His interpretation and representation, accordingly, must be *meaningful* for the child and also *be focused* on the learning aim, i.e., unlock the essence of the matter. He must try to plan his lesson aim (forms and ways of teaching) such that the formative quality of the matter is made optimally available.

These two reduction steps, consequently, require the formulation of a lesson aim in which there is harmony between *what* is taught and *how*. Thus, at this stage it is clear that the reduction of the theme by the teacher and his interpretation of the disclosed learning aim are of fundamental significance for any didactic design. Hence, it is necessary to pause here and indicate a number of additional aspects.

It was indicated that the reduction by the teacher is directed to laying bare what is really essential to the theme. This reduction gives the teacher greater certainty about the primary nature of the learning aim. Hence, reducing the learning contents makes the learning aim visible, i.e., what the child has to acquire for himself. However, for the teacher, this has additional implications. By formulating his teaching or lesson aim he not only has to reduce the theme to its essentials but he also must strive to present it in the proper context for the child so that the unique nature and structure of the subject matter, as an autonomous science, are disclosed. His lesson aim, then, must not only encompass the factual aim but also

show the form, i.e., the structure, relations, organization and good methods.

Any one-sided emphasis of the contents (language, symbols and formulas of the subject) easily can lead to confusion and to verbalisms (non-functional knowing).

From the above it is clear that the cardinal aspects of the learning aim cannot simply be read off of the syllabus but must be delimited and refined once again by the teacher. Then he must interpret the essentials of the matter and formulate his lesson aim accordingly. This brings us to the important aspect of stating the problem, and, in particular, how the disclosures resulting from the reduction event can give rise to a meaningful statement of the problem.

c) *The learning aim, stating the problem and reducing the learning material*

Above it was indicated that the learning aim already is embedded in the *theme* and that the theme is adopted in the curriculum because of its formative quality.

By the teacher's act of reduction, the learning aim is disclosed anew as the essence of the matter and is taken up in his lesson aim. However, where his lesson aim involves both the *what* and the *how* of the teaching event, it now becomes important to look at the path that must be followed to transform the *learning aim* into a problem for the child.

It makes no sense for the teacher merely to go into the classroom and simply announce the problem because in this way there is *no problem for the child*. Thus, at the beginning of a lesson, it is no use to announce the *theme* and postulate it as the learning aim. Before the situation can direct any appeal to the child its form as well as contents must have sense and meaning for the child. Only when the child himself gives meaning to the matter can he discover the incompleteness of his equipment, i.e., become aware of aspects that are strange and unclear and, thus, are problematic for him. The learning aim can be shaped into a problem for the child only if, on the basis of his ready knowledge and understanding, he is able to give meaning to it.

To make the problem meaningful for the child the learning aim must be changed into a question for him. Such a questioning attitude only can be actualized if the child can be stimulated to self-activity on the basis of his sensing of something unknown, strange, surprising or even amusing. As soon as he confronts the matter he begins to search for "something" known that he can isolate and name. Thus, he only can *give meaning* if a part-aspect appears that he recognizes on the basis of his foreknowledge. Consequently, on the basis of his awareness of the learning aim, it is the teacher's task to anticipate what foreknowledge must be actualized so it can be a starting point for stating a problem. (The actualization of foreknowledge is considered later in the chapter with respect to the course of the lesson).

Van der Stoep[31] also refers to the importance of a meaningful linking up with the foreknowledge of a child when he explains that "today it is generally accepted that the phenomenon of learning has its beginning in a meaningful problem". This means that when a child proceeds to give meaning to a theme, to order and systematize it, only then is he able to disclose to himself the incompleteness of his own knowing. The meaning of actualizing foreknowledge in an early stage of the course of a lesson is that particular knowledge, proficiencies and skills are made explicit and are the basis on which the first attribution of meaning by the child has its beginning. Because this foreknowledge already embraces *part aspects* of the final gestalt, this event already can be viewed as an *accompanied reduction*. In the actualized foreknowledge certain concepts are thrust to the foreground and then constitute part of the ultimate learning aim, but the child also is in a position to become aware of the *incompleteness* of his knowledge about the matter.

The disquiet, surprise and uncertainty that in this way are awakened in the child force him to distance himself from his *foreknowledge* and, once again, to cast doubt on what he already knows. Now the child approaches the matter more objectively through more accurate perceiving. This shows itself as an act of exploration and can be typified as a form of *self-reduction*.

[31] Van der Stoep, F., *Didaktiese grondvorme*, p. 41c.

Through his further analysis and attribution of meaning the child succeeds in delimiting a certain aspect as problematic or another as one of possible meaning.

For didactics this distinction between accompanied- and self-reduction points to two important concepts that have great relevance in planning the modes of learning and the choice of teaching aids. When the teacher succeeds in meaningfully linking the foreknowledge and learning aim and thus gives direction to the child's learning activities, the child also more easily will arrive at an awareness of a problem and, in doing so, will more quickly and directly begin to ask questions. These questions from the child are his first attempt to formulate his own problem that has become visible from the disclosures manifested by his own acts of reduction.

d) *Formulating the problem and reducing the learning material*
From the various questions that the learners now asks on the basis of their refined and directed perceiving one now can proceed to summarize the learning problem and formulate it in the language of the pupils. However, it still is a task for the teacher to complete and broaden the insights and perceptions of the children that still fall short of the mark. From the pupils' questions, based on their self-reduction, they can be led in a class discussion to formulate the problem. The problem, by which the essence of the theme is made clearly visible to the child as a learning aim, also must be summarized for him (the child) in understandable and familiar language. Regarding this Roth[32] adds: "In language suitable to the child's age."

When the pupil has arrived at his own formulation of the problem (learning aim) one can proceed to search for possible solutions. The general procedure is for the teacher to show one or another good example and then to deal with it together with the child and then give the child the opportunity to deal with it himself. At this stage of planning the lesson structure the choice of a good example is real and deserves further attention.

e) *The choice of example and reducing the learning content*

[32] Roth, H., *Leerpsychologie in pedagogisch perspektief*, p. 77a.

To unlock the learning aim for the child the teacher must select one or more examples by which the essence of the theme is made visible. Thus, it is necessary to search for examples that inherently contain and mirror for the child the essence(s) of the learning aim. To acquire greater assurance regarding the quality of the example and if it can be effectively used to expose the new, the example itself first must be *reduced*. Once the teacher, on the basis of his reduced-information, selects a particular example he must consider further whether such an example can be viewed as sufficient for the unlocking and if there must be a search for a supplementary example. Therefore, it only is possible, on the basis of the child's insight regarding the first example, for the teacher to plan further and determine to what extent provision must be made for additional examples. By choosing further examples and by determining their formative quality the teacher can plan his learning aim with greater certainty. The reduction of learning material never must be equated with a mere analysis or simplification because, although there is a search for the simple example, it must always be recognizable as a meaningful exemplar of a particular subject matter. Because for each subject matter there are certain examples that lend themselves better to designing a fruitful learning situation, it is necessary to go into this more deeply.

The example and the unique nature of the subject matter: In evaluating an example the nature of the subject must not be lost sight of. The field of study, its language, validity and typical methods all are aspects that can influence the choice of an example. Consequently, in most subjects there are particular examples that are extremely suitable for embodying a particular facet or aspect of the reality [of concern]. Here one thinks of classical, traditional and model cases where specific examples are used repeatedly by various persons to clarify a particular matter for others. The logical, exact and abstract character of mathematics makes it especially susceptible to the use of such fixed or even stereotypic examples in unlocking a particular concept.

The example and the method: The choice of a good example by the teacher not only is influenced by its intrinsic value for disclosing the essence of a concept and especially its linguistic meaning, but sometimes it is chosen primarily because it effectively shows a

particular approach or good method of solution. Here one thinks of the great variety of examples that generally are given in the class for practicing the usual methods for analyzing factors. This has to do mainly with the choice of examples by which a particular methodological *aspect* of the subject can be practiced. In addition to choosing an example because of its significance for unlocking the *what*, sometimes it is chosen also to unlock the *how*.

The example and meaningful relationships: In addition to choosing the example for its quality to clarify concepts or where it is applied and constructed to disclose a particular methodological aspect, the solution sometimes only breaks through in disclosing a new relationship. Herein lies the meaning of reproductive and productive tasks in each subject. The example now chosen must make possible a new structure (productive) or a restructuring (reproductive) of an earlier insight. In both of these thought-structures the example allows the *insight* to break through with respect to a new relationship or series of relationships by which the child is lead to arrive at the solution of the stated problem.

According to Van Hiele the course of matters in the origin of insight in geometry is described in the following four points:

> First a structuring occurs in the field of perceiving.
> The structuring in the field of perceiving is paired with various words.
> The structuring of the observable is increasingly taken over by the linguistic structuring.
> A certain autonomy of the linguistic structuring arises.

In other words, the realization of insight involves a perceptual structuring, a linguistic structuring and a logical structuring that partially work together and complement each other but that, in the long run, the latter supplants the former.

The example and the readiness of the child: Because the example (content) always is chosen for a particular subject matter and a certain class it is equally important to take into consideration the readiness of the child in order not to overlook the unique nature and structure of the particular subject matter. Before there can be

an appeal stemming from the content (example), it must be made sure that it is possible for the child to give sense and meaning to what he is confronting. Therefore, on the one hand, examples that are too difficult or foreign to life for the child must be avoided. On the other hand, examples that are too simple or concrete cannot show the quality in terms of which fruitful learning situations can be brought about. By choosing a too simple example the teacher loses the opportunity to confront the child with a meaningful problem that challenges his achieving consciousness and thus stimulates him. Too many realistic or concrete examples can only confuse and thus block clear concept formation.

Above an attempt is made to give an image of the teaching aim and how it figures in the reduction of the learning material in each phase of the teacher's preparation and delimitation of his lesson aim. The significance of all of this work of the teacher regarding the didactic design is, however, that it makes his practice possible. Therefore, it is necessary to attend to the course of the lesson and to show, along with the aim, the place and meaning of the reduction of the learning material in it.

3.3 THE COURSE OF THE LESSON AND REDUCING THE LEARNING MATERIAL

Each course of a lesson is a unique event that never can be repeated. The part-concept "course" refers to the fact that the lesson spans a particular time with certain activities that characterize its beginning; other activities continually repeat themselves as far as form is concerned during the progression of the lesson and then there also are particular matters that are distinguishable at its end. For a more differentiated discussion of the course of a lesson the following *six* phases are distinguished where each has a particular relationship to the question of the reduction of the learning material. First a synoptic scheme is given of the course or sequence structure as this generally actualizes itself with some modifications and stronger emphases of one or another aspect in each lesson situation.

Course of the lesson

Actualizing foreknowledge.
Stating and formulating the problem.
Exposing the new.
Actualizing the learning contents.
Functionalizing the new insights.
Evaluating.

Now there is an attempt briefly to show the significance of reducing the learning material for each of the various phases.

3.3.1 Actualizing foreknowledge

In order to more clearly grasp what precisely is planned during this phase of the lesson, it is necessary to elucidate certain concepts.

a) *What is actualizing?*

Actualizing is derived from the adjective *actual* that means real, essential, existing, actual, present or immediate and is adopted from the Middle English word *actuel. Actuel* further is traced back to the Latin *actualis, actus* and *agree* that mean to do or to act.

In everyday life actualizing has a wide variety of meanings such as making actual, realizing and to materialize.

b) *What is foreknowledge?*

In planning a lesson structure the teacher assumes that the pupils already have available a minimum amount of knowledge, proficiencies and skills that can be made explicit. Thus, actualizing foreknowledge means that only the relevant foreknowledge, i.e., what is viewed as necessary for giving meaning and solving the new theme, is recalled. Only the foreknowledge that the teacher views, on the basis of his reduction of the theme, as a meaningful starting point and basic insight is brought to the fore again. Such fundamental concepts, insights into relationships and methods that now are on hand each moment make the child susceptible and sensitive to the exposition of the new. The teacher cannot assume

that themes previously dealt with and that are relevant to the present situation merely are going to function spontaneously and obviously as explicit knowledge. Thus, his first task is to help the child to be secure and mobile regarding such beacons and focal points from which all future structures acquire their beginning. Therefore, to try to bring about the possibility for a meaningful unlocking, the teacher must anticipate a field of foreknowledge. By actualizing this relevant foreknowledge the foundation is prepared for a fruitful and meaningful linking up to and exposition of the new theme(s). Actualizing foreknowledge is an important aspect of the teacher's preparation and this requires an explication.

c) *Actualizing foreknowledge and the preparation by the teacher*

It was indicated that the content theme or learning aim is given in the syllabus for the teacher. However, in order to delimit and refine the learning aim to its essence, the teacher must reduce it and strip it of all details. But this is only part of the teacher's preparation. Before the new theme, as learning aim, can acquire any sense and meaning for the child the teacher must take care that certain basic concepts and methods of solution that are viewed as linking up points and beacons for further orientation, first are made explicit. The preparation by the teacher, as is observable in his lesson aim, requires thorough planning of the contents as well as the form moments regarding actualizing foreknowledge. It was indicated that as far as his preparation is concerned regarding the contents, on the one hand there must be a search for a linking up with the original and near to reality experiencing of the child. On the other hand, specific attention must be given to the *lesson form* in accordance with the level of readiness of the child and the nature of the subject matter.

d) *Actualizing foreknowledge and the choice of a lesson form*

As part of his preparation it is expected that the teacher reflect on the question of *lesson form* and how he aims to bring the contents to the fore again. In other words, this has to do with the choice of the most effective ground form(s) he is going to use to actualize the foreknowledge. However, to bring *movement* into an otherwise rigid lesson form the teacher cannot omit also thinking about one or

more principles of actualization and how they can help the child to actually and actively be involved in the learning event.

e) *Actualizing foreknowledge and the choice of certain didactic principles*

To try to provide greater security to the learning event and especially with the aim of the child's effective and active involvement in the event, in his preparation and planning the teacher finally also must decide what principle(s) of actualization, mode(s) of learning, teaching- and learning-aids he aims to implement in the lesson.

From the above it is clear that the teacher's planning of each phase of the lesson structure in general, just as here with his refection on actualizing foreknowledge, shows a clear interaction and dependence between the choice of the form as well as the content components and the lesson aim. Indirectly, therefore, this refers back to what had become visible as essence and constant when the teacher had reduced the learning material. Without the teacher delimiting the essentials of the matter he cannot succeed in anticipating and constructing a lesson structure that can lead to effective learning.

In the following phase of the course of a lesson, namely stating the problem, there is an attempt by the teacher to further stimulate the pupil such that the learning aim becomes a problem for him. In his striving and search for a possible solution the child then, himself, discloses the essences.

3.3.2 Stating and formulating the problem

Stating the problem is reached by putting the pupils in a situation in which the actualized foreknowledge is brought up and the sense and meaning of the matter is pointed out. At the same time, however, the child now becomes aware of the incompleteness of his knowledge about the matter. Becoming aware of "something" problematic forces the pupil back to the reality itself where he now tries further to *analyze* and distinguish between things that appear to be *known* and *unknown*. Should problems now arise, he is going

to turn to the adult by asking questions. The child's entry into reality with the aim of testing his knowledge of the matter and his questions to the adult both are expressions of purposive acts of reduction. Through his own lived experiencing of what appears to be a problem and the indications by the adults the child gradually arrives at a formulation of the problem. That is, the child succeeds in stating the problem in his own words. This then indicates to the teacher that the fruitful moment has dawned for presenting a solution or for providing help and support that makes the discovery possible.

3.3.3 Exposing the new

For the sake of clarity and lucidity a closer conceptual analysis is given.

a) *What is exposition?*
The concept is derived from the Latin *expositio* that means showing, exhibiting. In its turn, *expositio* is derived from *expositus*, the past participle of *exponere*, and means to expose, explain, clarify or elucidate.

In everyday usage exposition means to display, show, explain a logical concept by examples.

b) *Exposition and examples*
In the didactic theory regarding the ground forms it is clear that using the example for unlocking new learning contents is a form of living that, as a general lesson form, must be accepted in teaching. (The choice of a good example was broached in 3.2.3e). One or more examples now are shown by which the teacher tries to make the disclosure of the problem enjoyable for the child. Thus, the meaning of his exposition or explanation of the chosen example(s) is that it serves as an effective representation of the essence of the matter. In *explicating* the example the teacher intends to help the child himself be able to reduce the matter to its essence. Usually an example is chosen because of its simple and direct exposure of the solution to the problem, i.e., the essence of the matter as summarized in the learning aim and verbalized in the learning plan.

Here it certainly is necessary to indicate that the exposition of the new, either in the form of showing by the teacher or in the form of acting jointly, where the teacher along with the pupils penetrate the example, constitutes a necessary moment in planning most lessons. Usually a child will not be left to his own devices to search for a solution because this often is considered to be a fruitless use of time. By exposing a good example the adult helps the child more effectively penetrate to the essence of the matter and in doing so the child arrives at greater certainty and self-confidence regarding the particular aspect of reality. At the same time, the exposition helps show the pupils any specific or typical method(s) for solving the problem. The example the teacher chooses in order to delineate the essences of the learning aim now is a model for the child in terms of which he, on his own, can tackle new problems with greater confidence. Insight into the solution as presented by the teacher, however, is no guarantee that the child necessarily is able to solve similar or relevant problems on his own. Therefore, the exposing goes further and there is still one or more examples dealt with jointly with the pupils before they can try to deal with the problem on their own.

The example selected to be acted on jointly with the child also can serve as a medium for checking. After the initial explication it is necessary, as quickly as feasible, to check and determine the extent to which the pupils have acquired insight into the concept before any additional practice or rehearsal can have any value. Only after the teacher has made sure that the pupils have acquired the basic insights and when he has helped them make the fundamental knowledge and skills their own can there be a move to integrating and functionalizing the new content. In other words, the teacher must verify if the essence of the matter, as revealed during his original reduction, now is interpreted by the child accordingly. Thus, checking in this phase only means a checking of the essences or focal points that must be on hand as beacons before any additional constituting is possible.

Van Hiele[33] gives the following warning in this regard: “Also when full joint participation is provided the pupils there is a need for

[33] Van Hiele, P. M., *De Problematiek van het inzicht*, p. 122a.

continual checking. For the present the control aims at putting the pupils in the highest position to progress in the direction of the insight." Continual verification is needed. It must occur in each stage of a lesson so that there is certainty about the mastery of each new essence. Van der Stoep[34] says: "Without checking and guidance there is no accountability and responsibility, also no possibility of remedying the child's problems or correcting didactic errors (by the teacher)." Checking the essences in each phase of the course of a lesson therefore is a necessary task for every teacher because there is the danger that the pupils remain unsure about the matter. Because the explication by the teacher seems to be so logical and obvious this sometimes contributes to the pupils having the misconception that they understand the matter but as soon as they are pertinently confronted with the matter they first discover for themselves the real problems. From this it is clear that exposing the new always must be followed by activities that actualize the learning content.

The exposition of the teacher thus embraces a phase of the lesson structure in which the teacher shows "something" as well as where he works jointly with the pupils.

3.3.4 Actualizing the learning content

The main aim of this phase of the course of the lesson is to verify if the pupils have come ***to*** insight.

a) *Reviewing the essences*

There is the danger that the teacher, but especially the pupils, can have the mistaken impression that insight into one or two examples is sufficient and this can result in neglecting functionalizing the new knowledge. It is in this phase of the course of the lesson that a brief summary and synoptic scheme can be very helpful for the child to again orient himself to the matter in its totality and thus to see the essences in their mutual perspectives.

Thus, the new learning contents are summed up by the teacher and, where feasible, is illustrated. The reviewing, however, also can be directed to the child establishing greater skills and allowing him to

[34] Van der Stoep, F., *Didaktiese grondvorme*, p. 43c.

acquire greater mobility in applying specific methods. Consequently, reviewing is closely related to practicing. If during the rehearsing it becomes clear that the class or individual pupils still have not mastered the essences of the matter with insight, a situation must be planned in which the pupils jointly work on examples and even alone and by which the fruitful moment for the break-through of insight is brought about.

b) *Practicing **to** insight*
In general, at this stage, insight has broken through for most of the pupils and there can be a move to the additional *practicing **of** these insights* in terms of new and varied problems. However, it is possible that with some pupils insight is still lacking and an opportunity must be provided *for practicing not so much **of** insight* as the practicing ***to*** insight. By wrestling with a number of varied application problems the child learns to know the essences and interpret their meaning. An example(s) is now worked through jointly with the pupils or the usual procedure is that a number of carefully chosen and evaluated examples are given to the pupils to work through by themselves. It is important that the teacher first be certain that the child has acquired insight into the matter before there might be additional work.

c) *Naming and schematizing*
One must guard against the danger of verbalisms on the basis of too early a verbalization in the language of the particular subject area. Therefore, it is desirable that first the child try to give a possible solution in his own language before proceeding to an exact formulation with the help of other pupils or the teacher. However, before he can loosen himself from the specific example(s) and be able to think about the matter on an abstract level, and in a general sense, he must be led to delimit the essence of the matter and see it as a commonality. Therefore, a synoptic scheme and summarizing representation of the matter, at this stage of the course of the lesson, can be of great help to the child to see the general law, definition or inference. The essences and relationships become clarified by the schematizing and this directly helps the pupils to a better orientation.

3.3.5 Functionalizing as a moment of the course of the lesson

For greater clarity the concept of functionalizing first is explicated.

a) *What is functionalizing?*
Functionalizing is a derivation of the word *function* that means to work, working, performing a task, activity or a ministering. Function, in its turn, is adopted from the Old French *function* and the Latin *functio*. The past participle *functus* now means more specifically executing or performing.

The first functionalizing or learning activity in this stage of the course of the lesson is directed at the pupils' greater achievement and skillfulness. That is, through directly practicing the new knowledge it becomes one's own learned possession.

b) *Practicing **of** insight as a moment of functionalizing*
As indicated, there is a clear and important distinction between the concepts *practicing **to*** and *practicing **of*** insight. By presenting and working with examples jointly with the pupils, the teacher tries to guide them ***to*** insight into the essences, meaningful relationships and methods that refer to the learning aim. However, it is necessary that as soon as the insight has broken through one proceed to the practicing *of* insight. The aim here is to help the pupils to break loose from the particular example(s) shown and worked on jointly. Incidentally, this also involves actualizing learning activities that elevate the skillfulness of the child in using new methods of solution and approaches and, consequently, make him more mobile in using and applying the newly acquired knowledge and laws. Functionalizing eventually leads to committing the new knowledge to memory and to it becoming automatisms. However, before this new knowledge can be utilized fully and before broad knowledge and *possibilities of transfer* can be acquired, it first must be meaningfully integrated with the foreknowledge.

c) *Integration as a further moment of functionalizing*
There must be an attempt to indicate the meaningful relationships that exist between the newly acquired knowledge and germane ready knowledge. By integrating the new and the old there is a

progression to greater unity and general structures in terms of which the pupils, in subsequent applications can arrive at greater mobility and certainty. Van der Stoep[35] says the following about integration: "By integration, as a truism of learning, one must understand that the learning person already possesses a particular quantity of knowledge and that newly acquired knowledge must be assimilated and integrated into this already existing totality of knowledge. This matter has its cognitive and affective aspects and in this way touches all of the activities of the achieving consciousness."

d) *Applications and functionalizing*
The acquired insights now are practiced in terms of examples that the pupils themselves must work through. The sense and meaning of the applications are that the child now is confronted with new problems from related themes of the same subject or from neighboring subjects or even from reality outside of school. Thus, it is expected that the pupil will transfer his newly acquired insights and knowledge and apply them to matters (problems) that are detached from the examples by which he had originally learned them. Only in using his mathematical knowledge in daily life and applying this in solving problems in other subject areas such as physics and arithmetic does the child really discover the benefits and meanings of his new acquisitions. It also helps if he does not construct two worlds—one in the school and the other outside of school. Consequently, the mathematical knowledge, proficiencies and skills acquired in school actually have formative value. Only if there is a fruitfully applicable transfer and quickened tempo can the teacher accept that the insight is practiced.

Van Hiele[36] says: "Thus, we can say that insight always is recognized, as such, if the examinee intentionally acts adequately in new situations."

3.3.6 Evaluating

The concept evaluating first is clarified.

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[35] Van der Stoep, F., *Didaktiese grondvorme*, p. 81.
[36] Van Hiele, P. M., *De Problematiek van het inzicht*, p. 11b.

a) *What is evaluating?*
The verb *evaluate* means to estimate, to assess, to appraise, to rate or to value. The concept is derived from the Latin *valere* that means to be of strength or health or worth. In everyday life it has acquired the meaning of estimating, appraising and valuating.

b) *The aim of evaluating*
The aim of evaluating is to try to compare the *achievement* of the pupils as well as give the pupils the opportunity to disclose themselves. In addition to verifying the essences, an attempt is made to evaluate the essences of the learning aim, the methods, skills and applications in new situations. Thus there must be an attempt to evaluate insight as well as skills.

c) *The necessity of evaluation*
Evaluating the pupils is a necessity because in doing so the teacher checks *himself*. Evaluating not only helps the teacher form an image of his pupils' work but also of his own teaching. Problems of individual pupils and problems with which the whole class co-experiences difficulties in a particular sub-unit possibly can be indicated in a test.

About this, Alletson[37] says: "It is in the errors that the pupils' individual difficulties are manifested. A teacher ought to be as a doctor who by perceiving the symptoms of the sick can restore his patient to being healthy."

Thus, it is the teacher's task to analyze the errors that the pupils make on test and to look for their possible origins.

3.7 SUMMARY

The place and meaning of reducing the learning material mainly differentiate themselves into two moments: the preparation by the teacher where he delimits the lesson aim from the learning aim as taken up in the learning plan and the anticipation of an accountable course of a lesson. Because today it no longer is possible to offer

[37] Alletson, D. C., *Die onderwys van elementere Wiskunde*, p. 20b.

everything to the child, it is accepted that each theme taken up in the learning plan possesses formative quality; i.e., there is a first or earlier reduction by which the choice of the theme is justified. Consequently, the first task of the teacher is to reduce to its essences for himself the theme as taken up in the course of learning because he must attempt to plan his lesson aim so that the available formative quality of the matter is used optimally. These two reduction steps must lead to formulating a lesson aim within which there is harmony between the *what* (content) and the *how* (form) of teaching.

To make the problem meaningful for the child the learning aim must be changed into a question for the child. This questioning attitude only can be realized if the child can be stimulated to self-activity on the basis of his sensing something as unknown. As soon as the child steps up to the matter he searches for "something" that he can isolate and name as known. Thus, he only can attribute meaning if part aspects come to light that he recognizes on the basis of his foreknowledge. Therefore, it is the teacher's task to anticipate, on the basis of his awareness of the learning aim, what foreknowledge must be actualized. Actualizing foreknowledge is viewed as *guided reduction*. Then the child is in a position to become aware of the *incompleteness* of his existing knowledge about the matter. The uncertainty that this awakens in the child forces him to re-question what he already knows and this is typified as a form of *self-reduction* or *personal reduction*. Thus, the child succeeds in delimiting certain aspects as problematic for him that then leads to direct questions as the first attempt at formulating his own problem. Now the general procedure is that the teacher, on the basis of one or another good example, is going to show the example, another is jointly dealt with and then the child is given the opportunity to deal with many himself. Therefore, it is necessary to search for examples that inherently include the essences of the learning aim and can mirror them for the child. To acquire greater certainty regarding the quality of the example and if it can be applied effectively in exposing the new, the example(s) also first must *be reduced*.

In choosing a good example the nature of the subject, good methods of solution, meaningful relationships and the readiness of the child

must be considered. The meaning of all of this work by the teacher regarding the didactic design is that it makes his practice possible.

In the first phase of the course of the lesson foreknowledge is brought to the fore that, on the basis of his reduction of the theme, is viewed as meaningful points of linkage and basic insights. As part of his preparation it is expected that the teacher is able to reflect on the lesson form he is going to use to actualize the foreknowledge. However, to bring movement into an otherwise rigid lesson form the teacher also must reflect on implementing one or more principle of actualization. If, in terms of the accompanied reduction (actualization of the foreknowledge), the child is led, in his own self-reduction, to formulate a problem the further course of the less will proceed more or less as follows.

The example or examples that are chosen for exposing the new now are presented by the teacher, then one or more examples are jointly dealt with and then the pupils are given the opportunity to deal with a number of good examples themselves.

To form an image of his pupils' work and also of his own teaching the teacher must try to evaluate insight as well as skills.

In terms of the themes from the mathematics syllabus, the following chapter attempts to show, on the one hand, how the theory of the previous chapters can be transferred to practice. On the other hand, the examples can serve as *guidelines* for mathematics teachers who in the future are going to plan lesson situations themselves.