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ABSTRACT

This paper discusses grouping for instruction in teaching science. Suggestions include grouping students in science experiments and demonstrations, grouping by using videotapes and other audiovisual aids, flexible grouping, committee work, flexible discussion groups, minilessons, activity-centered teaching, modeling, individualized reading, and other forms of grouping. (CCM)

Grouping for Instruction in Teaching Science

by
Marlow Ediger

GROUPING FOR INSTRUCTION IN TEACHING SCIENCE

Much has been written pertaining to how to group pupils for instruction. Each pupil needs to learn as much as possible to achieve optimally. Too frequently, the merits of heterogeneous grouping is favored by educators. To be sure, pupils of unlike achievement need to be together and associate with each other. In society, people mix with others regardless of ability levels. Then too, in society, individuals seek out those who have a similar ability level. Why might school not be the same? Certainly, pupils need to learn to work together with others regardless of ability and achievement levels as well as be challenged by those of a similar level of attainment. Agne (1999) raises the question, "Are we sacrificing our children's education to satisfy a social agenda?" She wrote the following:

Parents and teachers have watched with dismay as, one by one, public schools hop on the inclusion- detracting train, seemingly in full compliance with the dictates of radical egalitarianism who, using public schools to drive their own political agendas, are bent on what they believe will save us all...

Tracking and ability grouping are clearly not without problems...The research is clear that all students need to be grouped with others whose learning needs are similar to their own in order to attain their best opportunity for highest achievement in basic academic subjects. The "one big happy family" ideal sounds lovely but stifles achievement capabilities, especially among the average and above average students, and in basic skills areas, it suppresses student achievement in all levels...

A commonly recognized fact among educators is that one method, formula, style, of curriculum is never sufficient, in and of itself. Teaching is far too complex for this to be true at any level or for any area of instruction. It is no less the case for ability grouping. One prescribed grouping format is never best for everything or everyone. There are certain subject areas and differing student abilities for which certain types of grouping arrangements may be best in one case, but not necessarily in another.

Pupils differ from each other in the intelligence(s) possessed such as in the following: naturalism, verbal/linguistic, logical/mathematics, visual/spatial, musical, bodily/kinesthetic, interpersonal, and intrapersonal (Gardner, 1993). Thus, the academic area of specialty and/or preference differs from one pupil to another as well as the preferred way of learning, be it within a group or individually. The science teacher then needs to assist each pupil to learn as much as possible in science, regardless of the intelligence area of subject matter preferred. Pupils live in a world of science and technology.

Grouping Students in Science Experiments/Demonstrations

The best plan of grouping used needs to guide each pupil to achieve as much as possible in knowledge, skills, and attitudinal objectives in ongoing science lessons and units of study. Science experiments and demonstrations, clearly visible to all in a class, might well stress using heterogeneous grouping. Gifted pupils may experience homogeneous grouping in which the experiment/demonstration is very sophisticated. The subject matter covered during these experiences needs to be explained clearly and concisely. Students should have ample opportunities to ask questions pertaining to gaps perceived in knowledge as well as knowledge that needs clarification. The science teacher needs to be very sensitive to all pupils obtaining necessary knowledge and skills as emphasized in the experiments and demonstration. Inductive learning can do much to minimize that which is not understood nor made meaningful. For example in doing experiments and demonstrations, pupils may be lead to access background information so that a better job of hypothesizing may be in the offing. Each hypothesis given by learners as to what will happen from the experiment/demonstration needs to be respected and printed on the chalkboard. When hypotheses are given, the teacher notices the quality of each. Thus, students reveal previous knowledge acquired and skill in hypothesizing. In an atmosphere of respect, pupils feel free to participate actively in the ongoing activity. After hypothesizing, the experiment/demonstration needs to be performed and students should observe very carefully as to what truly does happen. Too many students want to jump to hasty conclusions without careful observation. Rather, students need to develop quality skills in observing carefully.

Experiments/demonstrations may be repeated to verify objectivity. Verifiable knowledge is a hallmark of principles and laws in science. If the same results are not obtained, students with teacher guidance may discuss why there are discrepancies. Students individually or collaboratively may write journal entrees pertaining to what was learned. Collaboration may involve homogeneous or heterogeneous grouping. A key item here is that each pupil is respected and participates wholeheartedly. No one is minimized nor shunned. Writing observations made assists pupils to use knowledge as well as in retention. Active engagement by pupils in individual as well as in group work is commendable.

Grouping in Using Video-tapes, and Other Audio-visual Aids

How should students be grouped for instruction when AV presentations are provided as learning opportunities? Generally, the class as a whole, be they heterogeneously or homogeneously grouped, may observe the AV contents. The science teacher needs to be certain that each pupil has the necessary prerequisite knowledge to benefit optimally from observing the contents as well as grasping the related abstract ideas. If students do not have these prerequisites, they will tend to benefit only partially from the ongoing learning opportunity. To provide these prerequisites, the science teacher may ask question of students related to the AV presentation. Questioning activates the necessary background knowledge needed to comprehend the AV presentation. Having students tell about personal experiences that relate to contents in the AV activity are also appropriate. Learners do need to relate personally to the oncoming contents to be comprehended. Students then need to possess background ideas to understand the new learnings and become enthused about learning.

Vygotsky (1978) stressed the importance of the zone of proximal learning. Here, there is an initial gap between what the student knows presently and what is necessary to understand to benefit fully from the new experience. To take care of this gap, the science teacher may

1. perform a related experiment.
2. use advance organizers by explaining what is not understood prior to the new experience. The science teacher then is filling in with knowledge needed by students to understand the new content to be presented.
3. have students take a nearby excursion.
4. read aloud a few paragraphs from the basal or library book on the understanding level of students.
5. ask questions sequentially to guide pupils in comprehending the new subject matter.
6. show prerequisite illustrations, diagrams, charts, and graphs.
7. discuss selected objects with students.
8. encourage student predictions, from viewing the pictures and topical headings, as to what the new subject mater will entail.
9. have a resource person stimulate background information which sequentially leads to the new content to be learned.
10. motivate learners to tell what they know abut the new topic (Ediger, 1996, Chapter Five).

New subject matter in science can be acquired by many students if readiness is in evidence or the zone of proximal development has been narrowed greatly. If heterogeneous grouping is used in the classroom, the teacher needs to provide for a diverse set of individuals whose talents and abilities may vary greatly. If homogeneous grouping is involved, students still vary in talents and abilities in science, but the range will not be nearly as great.

Large group instruction needs to be followed with committee and individual endeavors so that all may benefit as optimally as possible. Thus, from the large group session, students may raise questions and problems to be discussed and data found within the committee setting. Each student also has subject matter that he/she wishes to learn and individualized instruction is important. An audio-visual presentation on Fossil Remains presented to the class as a whole, may be followed with committee work dealing with identified questions on these remains. In sequence, a student may wish to locate information on actual remains found of prehistoric animals, such as the woolly mammoth and the mastodon -- remains found in Siberia in what is now Russia.

Providing For Individual Differences in Newspaper/Newsmagazine Use

A quality current events program in science is vital. There are so many daily happenings in the news that involve science content. Thus, earthquakes, tornadoes, hurricanes, mud slides, avalanches, and cyclones receive much news coverage. There are several suggestions to be made in order to assist each learner to achieve more optimally in the science current events curriculum. These include the following:

1. read aloud selected science event items so that all pupils may understand salient structural ideas. Read with enthusiasm and face pupils when reading orally.
2. discuss relevant items to further assist pupils to attach meaning to content being emphasized.
3. guide each pupil to participate actively in the discussion.
4. use audio-visual aids to clarify facts, concepts, and generalizations with pupils.
5. have pupils work in small groups to elaborate on main ideas in science current events news.
6. use homogeneous groups to help pupils achieve on their individual levels of development.
7. use heterogeneous groups which involve projects whereby pupils on diverse levels of achievement may participate successfully.
8. foster respect among pupils for each other regardless of ability levels as well as foster respect for the teacher. Developing respect for each other should permeate all facets of the science curriculum.
9. have peers teach each other in small groups as well as emphasize peer teaching whereby a gifted/talented learner helps slower learners gain vital current events ideas.
10. maintain a high level of interest in current events, regardless of the type of grouping used, but the main point here is to have each pupil learn as much as possible (Ediger, 1997, Chapter Two).

Flexible Grouping in Science

A major generalization to stress in the grouping of pupils for instruction in science is to assist each to learn as much as possible. Thus a variety of procedures may be used in grouping for instruction.

Interest grouping may be used. There are numerous projects that pupils may work on in ongoing science units. If pupils are studying a unit on "The Weather and How It Affects Us," a small committee may wish to develop an art project showing different kinds of cloud formations, such as cumulus, stratus, and cirrus. Underneath each type of formation, pupils may write a description and elaborate on their effects upon the surrounding area. Pupils of similar interests may then work together on the project. Each pupil has a vital role to play in project development. All should contribute optimally. The most talented and gifted should not be expected to do all the work. Each pupil should achieve optimally here in terms of whatever he/she can contribute including as much as individual abilities permit to the project. My daughter, a computer programmer, states that in heterogeneously grouped committees, slower learners tend not to want to do any work. My challenge to teachers is to motivate each pupil do the best possible to develop an excellent science project and in any learning opportunity, regardless of grouping procedure used (Ediger, 1996, 25-27).

The completed project may be shared with classmates as well as be posted on a hallway bulletin board for other classes of pupils to observe. Curriculum improvement in science comes about when other teachers can see what is done in different classrooms and evaluate the end products as well as the inherent processes. Interest groups can work well in science teaching if leaners

1. perceive value in participating in a given activity.
2. attend carefully to contributing optimally.
3. desire to use individual talents in making contributions to the total committee project.
4. persevere in making a success of collaborative endeavors.
5. respect the optimal contributions of each learner on the committee (See Rao and Ediger, 1996, Chapter One).

Needs of Pupils and Committee Work

With flexible groups involving interest grouping for instruction, the needs of pupils may form another kind of collaborative setting. Here, the science teacher needs to be able to diagnose what a pupil needs to learn in ongoing lessons and units of study. What a group of pupils needs, provides a solid basis in grouping for instruction. Pupils may also volunteer to join a committee based on felt needs. Thus, the following needs may be experienced by pupils:

1. selected word recognition techniques to read science content in a meaningful manner.

2. comprehension skills when reading for a variety of purposes.

3. metacognition abilities to monitor one's very own success/weaknesses in reading.

4. application of what has been learned to every day situations in life.

5. critical thinking skills.

Some of the above needs are more difficult to remedy as compared to others. For example, remedying a word recognition skill in reading science materials may be much easier to remedy than developing critical thinking abilities. Meeting needs of pupils is very important in a quality science curriculum. Pupils individually achieve more when a specific need has been mastered, such as improving in comprehension skills. With improved comprehension skills, the learner then can understand more complex subject matter when reading science content.

Even though the grouping for remediation involves homogeneous grouping of pupils for instruction, learners therein still will be heterogeneous since selected pupils are further along in achievement within the collaborative setting as compared to the others. Thus, homogeneous grouping attempts to minimize the wide range of abilities within a group to be taught. The group is taught for as long a period of time as necessary and then modified or disbanded (Ediger, 1995, 1,2).

Groups Possessing Strengths

Groups should not be formed based on needs only, but also on strengths possessed. There are highly talented/gifted pupils in science in most classrooms. Adequate provision needs to be made to develop and maintain a challenging science curriculum for these learners. The "sky" should be the limit for the talented/gifted learner in science. Flexibility again is a key concept when forming collaborative settings for these pupils. Talented/gifted learners with teacher guidance may wish to engage in the following collaborative settlings:

1. planning and making scientific instruments directly related to an ongoing unit of study, such as a barometer, an hygrometer, an anemometer, a rainfall gauge, and a wind vane. These instruments may then be used in ongoing science experiments and demonstrations.

2. doing an indepth research report on causes of a specific natural disaster in the news, such as typhoons. Audio-visual aids, diagrams, and drawings may support the research project. A variety of reference sources should be used in data gathering.

3. studying and making a time line on the history of major natural disasters on the planet earth. The time line will contain the dates of each occurrence with a brief writeup on the causes for each disaster, such as the Lisbon, Portugal earthquake of 1555 which destroyed fifty

per cent of this city. A drawing may accompany each entry on the time line.

4. developing a video-tape on different salient space missions with accompanying drawings to show each, such as the following:

a) the Apollo mission resulted in the first humans landing on the moon in 1969:

b) Mariner 9 was placed in orbit around the planet Mars in 1971.

c) Mariner 10 came within 450 miles from the planet Mercury in 1974.

d) Pioneer Venus 1 was the first spacecraft to orbit Venus in 1978.

e) the Hubble Space Telescope was launched from a space shuttle in 1990 (Abruscato,1996).

5. identifying questions and problems which require answers from scientists whereby letter writing and/or e-mail may be used to correspond.

Flexible Discussion Groups

Discussion groups may be either homogeneous or heterogeneous depending upon how each pupil is affected to achieve as optimally as possible. If the topic is highly complex, then homogeneous grouping should be used to guide the talented and gifted to achieve optimally. Slower learners may also have challenging subject matter to learn as much as possible on an individual basis.

Discussions assist pupil to

1. analyze content being studied.
2. ask questions pertaining to what is not understood.
3. select problems areas for developing possible solutions.
4. probe indepth to content being discussed.
5. summarize subject matter learned.
6. develop a classroom science newspaper to correspond with parents and other interested persons.
7. brain storm possible solutions to gaps identified in knowledge being read.
8. record information presented in diary entrees and journal forms.
9. use ideas given to develop dioramas, murals, and models.
10. challenge ideas presented, in a positive way (Ediger, 1994, 24-25).

In any discussion, pupil need to respect each other and the ideas being presented. A caring and helpful community of learners needs to be in evidence within an ongoing discussion.

Grouping for a Minilesson

There are occasions whereby a minilesson may be taught on a relevant topic. For example, supposing the temperature readings reach an all time low in a winter month during the school year, the science teacher may wish to teach a short lesson on possible causes for the low temperature readings. A deductive/inductive procedure of instruction may be used here. Generally, in whatever is taught, the teacher explains (deduction) as well as raises questions (induction). Learners too should contribute with questions raised pertaining to what is not understood as well as to identify vital questions. The grouping used here may be either homogeneous or heterogeneous. A combination of the two plans might also be used in order to assist each pupil to learn as much as possible. The minilesson needs to possess clearly stated objectives. The learning opportunities need to relate directly to the stated objectives and provide for pupils individually to learn as much as possible. Guidelines to use in teaching a minilesson are the following:

1. emphasize concrete (objects, items, experiments, demonstrations, and excursions), semiconcrete materials (audio-visual aids, illustrations, drawings, diagrams, CD ROMS, and software packages), as well as abstract learning activities (tapes, reading, writing, speaking, and listening experiences).
2. obtain the attention of all pupils so that optimal achievement may be possible.
3. use eye contact with and for each pupil in the minilesson in order that he/she may feel that a personal means of communication is in evidence.
4. stress higher order levels of cognition where feasible, such as critical and creative thinking as well as problem solving.
5. encourage and model respect for all in each lesson. Pupils as well as the teacher need utmost respect for quality learning to occur (Ediger, 1999, 15-22).

Activity Centered Teaching and Grouping Pupils for Instruction

Activity centered teaching involves pupils learning by doing whereby psychomotor objectives prevail, but does include cognition as well as good attitudes. There tends to be interaction among cognitive, psychomotor (use of eye-hand coordination), and attitudinal ends. It is important that pupils become skilled in use of the gross and finer muscles in being actively involved in the science curriculum. Engagement in learning is of utmost importance. Too frequently, pupils are passive recipients of knowledge, rather than being wholeheartedly involved in ongoing experiences in the science curriculum.

Which learning activities, related to a specific science unit of study, involve a learning by doing approach with active involvement by pupils in flexible grouping?

1. making dioramas of prehistoric sea life, such as pleisosaurs and mososaurs, as well as of animal life on land, such as the ground sloth and the saber tooth tiger. Considerable research may be done on gathering information on these forms of life to present to the entire class when showing the completed dioramas.

2. drawing a sequential set of illustrations pertaining to sheet and gully erosion as well as remedies to prevent misuse of valuable topsoil.

3. dramatizing important scenes from the lives of famous scientists, such as Louis Pasteur, Joseph Lister, Michael Faraday, George Westinghouse, and Anton Leuvenhook.

4. developing a classification chart of animals with backbones (vertebrates), such as fish, amphibians, reptiles, birds, and mammals. Pictures may be drawn and/or brought to class pertaining to each classification of animal.

5. a mobile may be planned and completed on animals without backbones (invertebrates), such as sponges, coelenterates, worms, mollusks, echinoderms, and arthropods (Ediger, 1997, 140-160).

Each of the above named five categories of activity centered approaches in learning require a considerable amount of background information which pupils may obtain from diverse reference sources. Thus, pupils with teacher guidance need to perceive a purpose for each learning opportunity, plan to achieve the purpose, carry out the planned activity, and evaluate the completed tasks. A learning by doing approach in science emphasizes pupils being engaged in achieving quality objectives in science lessons and units of study.

Grouping and Modeling

Frequently, pupils needs to observe good models to do well in a skill or achieve an attitude. The science teacher then may present a model for learners to observe pertaining to oral reading, writing for a variety of reasons, doing an experiment or demonstration, making a replica, doing art work, working on a construction activity, showing democratic behavior, and being a quality member of a discussion group.

Many children and adults model themselves after the behavior of others. Role models then are a necessity. Why? These role models give pupils an opportunity to try out and see if what is being followed from a model's behavior is working for the well being of all. Usually, what has be observed from a role model needs to be modified, in degrees, to fit the observer's ideal. Each pupil has purposes in life and viewing diverse good role models provides more options for pupils to emulate in order to develop unique forms of desirable behavior. Thus, for example, in writing science content, the teacher may model the following, depending on the present achievement level of pupils:

1. writing a business letter to order free and inexpensive science materials for classroom use.
2. writing a friendly letter thanking the providers for an enjoyable and productive field trip.
3. writing a set of directions for making a model object pertaining to an ongoing lesson or unit of study in science.
4. writing an outline covering vital content from the basal.
5. writing a summary of a library book read.
6. writing an abstract of an article read.
7. writing a bibliography of references used in solving a problem.
8. writing an evaluation of science content read from a journal article.
9. writing a creative story on space exploration.
10. writing a synopsis of a current event science item.

From the model presented, the leaner may write with the involved purpose an achieve as much as abilities and talents permit. Each pupil needs to be respected for what is being achieved in writing. The goal in writing is to move from where the pupil is presently in writing to some further ideal involving continuous progress.

Grouping and Individualized Reading in Science

With individualized reading, the issue of homogeneous versus heterogeneous grouping basically does not exist. A wide variety of titles in science content and written on different levels of pupil achievement should be in the offing at the reading corner. A pupil may then select a library book to read on his/her present level of reading achievement. The chosen library book is usually selected based on personal interests of the involved learner. The science teacher may help the pupil in book selection if the latter can not make a choice.

After a pupil has completed reading his/her selected library book, a conference may be held with the science teacher. Questions for discussion may be raised by the teacher to evaluate learner comprehension of content. This evaluation session should not destroy but encourage increased interest in reading science materials. What might be objectives, here, in the conference setting for appraisal of pupil achievement?

1. noticing pupil fluency in reading aloud a brief selection from the library book.
2. appraising word recognition skills of the learner.
3. ascertaining pupil interest in reading science subject matter.
4. determining the quality of reading comprehension.

5. progress being made by the pupil based on notes kept on a previous pupil/teacher conference.

6. improved attitudes possessed by the learner toward reading.

7. pupil's reading as many library books as possible during the allotted time.

8. selecting science materials to read during sustained silent reading (SSR).

9. wanting to improve reading skills to obtain vital facts, concepts, and generalizations, as well as to read critically and creatively to solve problems.

10. relating subject mater read to ongoing lessons and units of study in science (Ediger, 1999, Chapter Two).

Additional Forms of Grouping Pupils for Science Instruction

There are additional ways to group pupils for instruction so that each may achieve more optimally. Thus, a departmentalized plan may be used. In secondary schools for years, departmentalization has been in evidence, whereas in elementary schools, the self contained classroom is in vogue. In a self contained classroom, the teacher basically teaches all curriculum areas, except music, art, and physical education. Complaints here are that the elementary generalist cannot possibly specialize in teaching so many curriculum areas. Something then has to give. In departmentalization, the teacher is specially trained to teach science. His/her undergraduate preparation indicates a major in science content and science teaching methodology. A key item in the debate has to do with how well the teacher is able to assist pupils to achieve relevant subject matter, skills, and attitudes. There are elementary schools whereby two teachers have arranged classes so that one uses talents for teaching science and the other for teaching, for example, mathematics. Modified departmentalization has strengthened the teaching of specific curriculum areas in which each teacher uses strengths for teaching, such as in science instruction.

A second additional way to group for science instruction is to stress multiage classrooms. Here, younger and older pupils may work together on a given task, such as constructing a terrarium to observe animals in a humane environment. Pupils of different ages in a specific group may be either homogeneously or heterogeneously grouped. The argument used for multiage grouping is that in society, younger and older individuals interact with each other. Also, age levels may mean little when it comes to achievement in science. Thus, selected younger pupils achieve at a higher level as compared to older learners, as well as vice versa.

Third, cross grade grouping may also be used. Pupils from a specific grade level may be grouped with learners from another grade level. The purpose here might be to have homogeneous groups. Thus, pupils from grades one and two may work together on a project, such as making a chart on plant classification, including algae, mosses, ferns, evergreens (nondeciduous), and deciduous trees. The goal is not to have cross grade grouping for its own sake, but rather to help each pupil learn as much as possible in science. A few lower grade level pupils my have achieved at a higher level in the science curriculum as compared to those on higher grade levels.

Fourth, team teaching may be used. A teaching team may consist of two or more teachers in teaching a given set of learners in the area of science. These two or more teachers need to plan cooperatively the objectives, learning opportunities, and appraisal procedures for teaching and learning. Large and small groups need to be in the offing as well as individual study for pupils, taught and supervised by the teaching team. Plans developed and implemented need to assist pupils individually to achieve as optimally as possible in science.

Fifth, learning centers may be set up in the classroom. With learning centers, it does not matter how homogeneously or heterogeneously the pupils are within a class. If twenty-five pupils, for example, are in a classroom, eight learning centers may be set up. Each center has approximately five tasks listed on cards for pupils to select from. There are more tasks available than what any one pupil can complete. This makes for choices and decision making on the part of each learner as to what he/she would like to work on and complete in terms of learning opportunities in science. There can be individual as well as collaborative tasks to choose from. The pupil makes the decision. Time on task is vital here! The science teacher is a guide and stimulator to encourage pupil learning, not a lecturer nor a dispenser of information.

Sixth, looping has become an important concept in teaching science (Denault, 1999). With looping, a pupil stays with the same teacher for a longer period of time than one school year. The argument given for accepting looping in grouping pupils for instruction is that the teacher may provide better sequence in learning by getting to know learners well as compared to pupils changing teachers each school year. When changing teachers each school year, the new teacher starts anew with getting to know the skills and abilities possessed by a learner. This generally takes about a month. Disagreements pertaining to stressing looping in grouping pupils for instruction pertains to a pupil who may prefer another teacher who can better meet his/her personal needs.

In Closing

There are numerous plans available for grouping pupils for instruction in science. The major goal in grouping learners for instruction is to assist each pupil to achieve as much as possible in ongoing lessons and units of study. This eliminates the need for

1. setting high standards for pupils to achieve by those outside the local classroom and school district, such as those who write standardized tests and state mandated objectives and tests. However, both standardized tests and state mandated test results may be used for diagnostic purposes. Thus, the science teacher may notice from each pupil's results what has been missed and, if vital, needs to be stressed in ongoing lessons and units of study.

2. worrying about the homogeneous/heterogeneous grouping controversy.

Constructivism as a philosophy of instruction stresses that which is done in a classroom is what is important. Thus, the objectives, learning opportunities, and evaluation procedures developed in the classroom are of utmost importance. Within an ongoing lesson or unit of instruction, pupils with teacher guidance appraise and evaluate what needs to be improved upon. Individual and group activities need to be in evidence to provide for each learner's optimal progress. In school and in society, human beings work individually as well as collaboratively. They also interact with others homogeneously as well as heterogeneously. So both approaches may be used here in grouping pupils for science instruction with constructivism used as a philosophy of instruction.

In grouping pupils for teaching science, the following guidelines may be used, stated in question form:

1. Which procedures assist pupils best to engage in inquiry learning?

2. How can experiments and demonstrations be most successful when stressing a specific plan of grouping leaners for instruction?

3. What might be done in grouping learners to minimize failure in learning in the science curriculum?

4. How might inservice education assist teachers in grouping pupils successfully so that all may be achieve as much as possible in knowledge, skills, and attitudes in the science curriculum?

5. What is the relationship between quality grouping practices and the use of technology to help each pupil learn as much as possible in science?

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