

# **A Christian perspective on Mathematics – history of Mathematics and study guides**

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## **1. Introduction**

At previous conferences of the ACMS I spoke on the matter of introducing a Christian perspective on Mathematics in a Mathematics class by means of the *science in context approach* (or contextual approach). In this presentation special consideration will be given to the following two questions, both of which relate to the science in context approach:

- (a) Will a study of the history of the subject serve any purpose in promoting a Christian perspective on Mathematics?
- (b) Can a good educational planning strategy of the science in context approach (in a study guide) perhaps even be of further assistance in promoting the integration of a Christian perspective on the subject?

## **2. A brief summary of the viewpoint of *science in context***

To begin with, I would like to give a brief summary of the viewpoint of science in context. In order to do that, I must first stress the following two personal points of departure.

*First point of departure:* Man's life is integral without being compartmentalised into the religious and the non-religious.

No part of one's life can therefore be labelled as "secular". Fowler (1981:7) puts it very strongly when he says: "In the biblical view religion is not, and cannot be, a dimension of human life. It is the very heart and soul of life. ... Activities outside cultic activities are just as much religious activities, even though religious faith is not made explicit in them, as cultic activities."

*Second point of departure:* Every aspect of a subject field should be viewed in the context of other, wider aspects, such as the history of the subject, the laws of science, science in general (with its different viewpoints and paradigm shifts), nature and religion.

I call this view the *view of science in context*. Stoker (1976:135) phrases it as follows: "The above provides us ... with an argument for the necessity of fulfilling our Christian calling of doing science, we being committed to do science within the context of ... our Christian life and world view – and in accordance with the relational demands of the various fields of research of the various sciences." A visualisation of this viewpoint is given by Stoker when he explains (1976:138): "These contexts ... can be illustrated by means of a set of concentric circles". In contrast to this view there is the logical positivist view, the so-called *standard view of science*.

The science in context point of view therefore affords a wider and broader view of science than what is usually regarded as the subject field. Seen as such a wide activity, people of different points of view will usually not view the details of a subject like Mathematics differently. When it comes to the broader scientific field, however, they will indeed view it differently.

The science in context viewpoint provides a useful framework for class discussions. It can be used in a continuous, well-planned manner for a weekly or biweekly class discussion, without becoming artificial or arbitrary.

I use the following contexts for my classes, though of course others could be added and they do not need to be discussed in this specific order.

The context of history

The context of mathematical theories and relationships

The context of science and society

The context of nature (creation)

The context of religion.

In written form, these topics for discussion are between one and three pages long and they are handed out to the students as part of their study guides.

It would perhaps be helpful to look at the following example of such a science in context approach. This applies to a typical course in mathematics:

*Introductory discussion:* What is Mathematics? Is it possible to study Mathematics from a Christian point of view? A short discussion of the *view of science in context* as basis for a class discussion.

*The context of history:* Some historical aspects, foundational matters and paradigm shifts with regard to the subject.

*The context of mathematical theories and models:* What is a theory? Induction and deduction in science. Mathematical induction. Scientific models and reality.

*The context of science and society:* Different scientific views: positivism, logical positivism, post-modernism, etc. The "power" of science. The idealisation of science and mathematics. The ethics of mathematics (if applicable).

*The context of creation:* Different world views (with reference to mathematics too). The beauty of God's creation as described in Psalms 8 and 19.

*The context of religion:* The science/theology debate. Can mathematics be one's idol/religion? God as sustainer of His creation.

Over time I have come to realise that a discussion of this nature adds value to a Mathematics class. I have also found that such a discussion should neither be too complex nor too long. It should preferably be done in an informal way, and definitely on a regular basis.

If desired, one can start off with the historical context. It does not provide a Christian perspective per se, but at least it provides a fairly simple and straightforward starting point.

I fit a discussion of these five contexts, together with a first, explanatory discussion, into a term of twelve weeks. A discussion session is held approximately once every two weeks.

I also try to link one or more of these contextual discussions to a specific part of the mathematics course, but it is not always easy, or possible, to accomplish that.

### **3. A Christian perspective *on* mathematics?**

It is now already some years that I structure my classes according to a science in context approach. I think I can say that these attempts have been fairly successful.

Unfortunately some questions remain. I would like to mention the following two questions, the discussion of which forms the main part of the rest of this presentation:

- Can the viewpoint of science in context in fact be utilised to introduce a Christian perspective *on* the subject, or does it only succeed in bringing some perspective *next* to the subject?
- Can a good educational planning strategy perhaps even be of further assistance in promoting the integration of a Christian perspective *on* the subject?

As you will realise, both questions relate to the degree of success one has with the integration of a Christian perspective *on* Mathematics with the mathematical content of the course itself.

Over the last year or two I have given these matters a great deal of thought, experimenting with some new ideas in classes, and I would like to discuss these with you.

### **4. The history of mathematics in Mathematics**

I would like to elucidate the first point raised in the previous section (that is, the matter of a Christian perspective *on* the subject content versus a perspective *next to* the subject content) by mentioning the following example from classical mechanics:

When studying the motion of the planets around the sun, the context of creation can be discussed at the same time. In this way a good integration can be accomplished between the philosophical and mathematical topics.

Unfortunately such a link between philosophical and mathematical matters is not always attainable. These matters can remain in two separate compartments – and then of course there will be comments about a dualistic approach (like two trains travelling on separate, parallel tracks).

In order to address this problem, I started to concentrate more on the history of the subject – specifically in one of my courses, namely classical mechanics. In this way I hoped to build a firmer bridge between the Christian perspective on the subject and the subject itself.

*My* reason for including the history of the subject is of course to find a better integration between a Christian perspective on the subject and the subject matter itself. But I would also like to cite some other reasons, stated in the literature, for studying the history of a subject. Consider the following:

- It can give motivation to those students "who are alienated by the impersonal, wholly rational, and logical approach emphasized by most ... textbooks" (Kauffman, 1991: 186).
- It can teach students "a feeling for the movement, progress, and continuous change inherent in science" (Kauffman, 1991:187), in contrast to the view that science is a finalised endeavour.
- It can also give the lecturer/teacher a richer and more authentic understanding of science in general (Matthews, 1994:7).
- It can draw the attention of students to the "crossroads", "bifurcations" and "intersections" of the scientific road. Serres (1995:1) remarks: "... we need a *history of science and technology*" and continues (1995:4): "... the history of science is becoming the cornerstone of contemporary culture ..."
- It can be used to teach "human values" to students; Seeger (1980:881) remarks: "... scientists are people and ... students are people; why not introduce them to each other?"

Some of the persons who helped to establish mechanics whom I feel one should discuss in a classical mechanics class are Archimedes, Buridan, Oresme, Copernicus, Stevinus, Tycho-Brahe, Galileo, Descartes, Huygens, Newton and Euler.

I would like to add the following comments:

- Although the personal biographies of historical figures are of importance, one should always remember that the main point of interest should be the philosophical ideas and paradigms of each scientist's time, and not the biographies themselves.
- One should try – at least in some cases – to find a link between a particular scientist and a specific problem of mechanics.

I would like to give a short evaluation of such an approach. The question previously asked remains: Does the study of a subject's history help to promote an integrated Christian perspective *on* the (mathematical) subject itself?

Firstly, I think the answer largely depends on one's understanding of the phrase "integrated Christian perspective".

However, without exploring this aspect further, I think one can safely state that at least some of the following matters will result from such an approach:

- One can guide students to the point of realising that there is a relationship between mathematical matters on the one hand and the wide field of reality on the other.
- One can bring students to the point where it is easier for them to understand the technical matters of a subject because these latter aspects are "softened" to some degree by the historical aspects.
- One can help students realise that the viewpoint of a Christian scholar can indeed play a role in his scientific work. Kepler is a very good case in point with his view that God constructed the universe according to a mathematical (geometrical) scheme. [See Kozhamthadam's book (1994) on the life of Kepler: *The discovery of Kepler's laws – The interaction of science, philosophy and religion.*]

- One can counter the view that a subject is a real and complete entity that can stand on its own, totally divorced from reality, by studying the history of a subject. Hooykaas (1994:12) puts it as follows: "The teaching of science is more than technical training. If we restrict ourselves to the latter, the psychological effect will be that the scientific world picture is taken to be the real and full one, representing all that can be said with certainty about the universe and mankind."
- In this way one can avoid educating intelligent specialists who possess no knowledge of the frameworks of thought and paradigms underlying their subject. Rather, they will have insight into the history of the subject as well as the philosophical views of the specific time. Du Plessis (2000:1) puts it in this way: "A bad university therefore is a university where we train specialists without foundational knowledge, specialists who lack knowledge of the thought systems and paradigms of their subject fields."

I can therefore conclude this section with the following comment: If there are only a couple of students in my class who, in some sense, have been positively influenced by the study of the history of the subject, then, to my mind the study has served a good purpose.

## **5. The role of a good study guide in promoting the integration of a Christian perspective on the subject**

I would also like to address the second question posed earlier (in section 3), namely: Can a good educational planning strategy perhaps even be of further help in promoting the integration of a Christian perspective on the subject?

At my university we are in the process of implementing a new series of study guides for all courses, therefore also for Mathematics. At first we had some negative feelings about "all kinds of new ideas, new viewpoints, new outcomes, etc". Gradually, however, there came a change of mind, and we realised that new study guides will also create new opportunities with regard to the issue of presenting a Christian perspective on our subjects.

In our new study guides much more self-activity is required from the students (or learners, as they are now called). It remains to be seen how much of this will be realised in practice.

In any case, our new study guides do provide new opportunities. I would like to share with you the following brief descriptions from my study guide on Mechanics to show in what way I have tried to bring a Christian perspective on the subject.

### *Example*

*Week 1:* "In *learning unit 1* ('What does modern Applied Mathematics involve?') the question concerning the character of modern Applied Mathematics is raised. As part of this discussion attention is also paid to the question of a Christian character of Applied Mathematics, including the question of whether it is possible to have a Christian perspective on a mathematical subject."

*Week 3:* "In *learning unit 3* ('Kinematics of a particle') we start with the mathematical formulation of Mechanics. However, to fully understand the development of Mechanics as a subject field, it is also necessary to pay attention to the history and development of the subject. Special emphasis is placed on Newton's role in the formalisation of the subject as we know it today."

*Week 5:* “At the end of *learning unit 3* (‘Kinematics of a particle’) it is emphasised that the development of a subject field is of great importance. However, as it is not sufficient to study only some historical aspects of the subject, attention is also paid to the role of mathematical and other scientific theories and tools in the building of the subject. For instance, for a Christian scientist it is important to know to what extent results from Mathematics and Mechanics are ‘true’ or ‘untrue’. At the end of the study you should be able to give your own view on these matters.”

*Week 6:* “As our subject unfolds still further the emphasis in *learning unit 4* (‘Kinetics of a particle’) is placed on the fact that Dynamics is not an entity that can be separated from reality. Therefore attention is paid to the context of science and society as they concern our course in particular. Every student has to realise that he/she as a scientist has a certain view on science. Einstein is discussed as an example: he had a certain viewpoint with regard to Mathematics – and similarly every Christian mathematician should also have his/her own point of view on the subject.”

*Week 10:* “In the last learning unit, *learning unit 6* (‘Motion of a rigid body’) the culmination of the module is reached. We are now at the stage where many problems from reality are described as mathematical problems. These problems – mostly of a mechanical nature – must be solved and the solutions must be interpreted. For this process it is important to realise that the systematised subject Mechanics is a mathematical representation of aspects of reality, but that it does not equal nature. Creation remains an entity that we can study with our scientific (and in particular, mathematical) ability, but we should not see Mathematics as a ‘power’ by which we can dominate creation. We should also realise that we use scientific laws only to describe nature – contrary to the popular belief that scientific laws ‘govern’ nature.”

*Week 12:* “The physical laws are man’s description of God’s creational laws. Therefore, in the last week of this module it is emphasised that Mathematics is an aid to study some aspects of these creational laws – and that the study of Mechanics plays an important role in this process. In addition to this, it is important to realise (a) that we use Mathematics in general (and Mechanics in particular) to study God’s creation, but that it is not a "god" in itself and (b) that everyone must reach a point where he or she has to glorify God for His creation as we observe it through our mathematical spectacles.”

## 5. Concluding remarks

The aforementioned contextual discussions could, of course, be extended in all directions and much more detail can be added. However, I think such class discussions should always be attainable and sustainable. I would like to conclude with some additional comments:

- *History of the subject:* The amount of information available on the history of the subject is unlimited – and one should be careful not to dish out too much work. On the other hand, this context provides the opportunity to focus the attention of students on the underlying difficulties of science (and of the subject).
- *Science and society:* As far as the ethical matters of some subjects are concerned, there are also many topics for class discussions (depending on the specific study field). However, one should resist the temptation to discuss only ethical matters, forgetting the other contexts. From this context onwards, students also have the opportunity to share their own viewpoints on different matters.

- *Creation*: Some further lines can be drawn concerning the context of creation. For example, one can draw students' attention to the fact that nature tells us something of the glory, wisdom and omnipotence of God. It also tells us that God sustains and governs his creation. He gives Earth and everything on it "that they may serve man, in order that man may serve God" (Belgic Confession, article 12). By challenging students to formulate their own viewpoints on the context of creation, students with differing points of view can also be accommodated.
- *Religion*: This last context is perhaps the one that still requires more attention in my classes. In my view the following matters should also be raised in class:
  - (a) God's *faithfulness* in his creation (Ps 36:5): "Your love is faithful, LORD, and even the clouds in the sky can depend on you."
  - (b) God's *order* in his creation (Ps 148:6): "He made them (the solar bodies) to last for ever, and nothing can change what He has done" (*Contemporary English Version*).

Again, by challenging students to formulate their own points of view one can accommodate students with other beliefs.

In this presentation it was my intention to address two matters relating to the science in context approach, namely:

- (a) Will a study of the history of the subject serve any purpose in promoting a Christian perspective on Mathematics? and
- (b) Will a good educational planning strategy (in a study guide) of the science in context approach perhaps be of even more help in promoting the integration of a Christian perspective on the subject?

With this discussion I hope to have shown that these two questions can indeed be answered positively.

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