THE CHALLENGE OF LOGARITMS IN TECHNOLOGY EDUCATION

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Restricted only to the starting level mathematical exercises for radio communication we may still study principles of several technical systems because detection of radio waves is tied to technology. Learning these phenomena requires formal thinking of physics, basic concepts of signal and skills in mathematical procedures. Today, the phenomenon of wirelessly transmitted data with its associated systems is an everyday fact. In school education, phenomena are described as concepts of physics, in which quantities and units follow the SI concept (e.g. Kurki-Suonio, 2013).

Yet practical radio engineering may unpleasantly surprise an inexperienced and one solution-oriented student. This study examines the differences between two didactical approaches (formalisms): subject-didactic physics and pragmatism-oriented engineering (solution-oriented calculation based practises). Main issue for learning is how well logarithmic calculation and ready-made formulas are related to each problem under consideration. We will include empirical observations on how to solve aims in the curriculum.

Our research questions are: 1) How to work with the “free space attenuation” concept? 2) How to work with the two competing didactical approaches (formalisms) in calculation and how to teach based on the findings?

We present reasons for existence of traditional and partly forgotten calculation methods. The early innovations utilizing radio waves date back to an era when distance was measured with the practical units and concepts were just named. Correspondingly, the calculation aids were simple: a slide rule (en.wikipedia.org) and various spreadsheet books (e.g. Kivelä, 2005). Thus, for calculations, it was natural to utilize various shortcuts and features or even memory rules. Most of radio engineering calculation problems were transformed into logarithmic thinking so the result was evaluated by addition and by subtraction. Unfortunately, the result thus obtained is related to the chosen model of units. Today numeric value is easily achieved, but the data might still be mixed with tradition in engineering or in SI-units. On the other hand in modern acoustics, where the logarithmic model for perception and hearing works well, there seems to be no problems as long as the traditions of the field are still followed. (e.g. Hänninen, 2015).

For better learning it is necessary refresh both the physical phenomena of wave propagation and the basic calculation rules on logarithm. It is also essential to show in practise, how any logarithmic value is formed or to be returned to the linear (Physics type) value. An example, the directivity for antenna is always in decibels. This value cannot be entered into a formula with the SI notation, a transformation must be made. But it is just fine for any logarithmic based engineering formula. In order to obtain a more accurate result detailed models as well as ready-made formulas or even applications are available. For rough estimate utilization and understanding the free space attenuation model is still an invaluable tool. It may also clarify the principles of calculations. Therefore, in education both didactical approaches are relevant.

References

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