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Kiyanovska N.M.

Assistant professor,

PhD of Higher Mathematics Department

State Higher Educational Institution

"Kryvyi Rih National University", Ukraine

THE USE OF COMPUTER ALGEBRA SOFTWARE PACKAGE IN THE TEACHING OF ENGINEERING MATHEMATICS

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The role of mathematics lecturer as an educator is very important in teaching the subject matter in encouraging and effective way. A lot of studies have investigated into the impact of teacher related factors on the students learning mathematics and students performance in mathematics. The way the lecturer teaches results from the good subject knowledge and the kind of perceptions that the lecturer has toward mathematics. Normally, most of the lecturers use the teacher-centred learning (TCL) approach in the process of teaching and learning at universities. The TCL approach is the method of teaching which promotes the passive participation of students in the teaching and learning process. In solving mathematics problems the lecturers are more focused on textbooks, rules and procedures as their instructional practices and these lead to the TCL approach [1].

Teaching methods formal lectures or TCL in spite of all criticism of formal lectures they still remain the main teaching method used. Formal lectures alone are not particularly effective in teaching mathematics because of a number of reasons. Mathematical courses are built in such a way that if a student misses a key concept at the beginning of the lecture, the rest of the lecture can be lost for him or her. Besides, every student has his or her own pace of acquiring mathematical knowledge. The pace of the lecture can be too slow for some students and too

quick for others. Finally, formal lectures can deprive students from using their initiative, encouraging surface/ atomistic rather than deep/holistic learning. The obvious way of overcoming many of these problems is to give students motivation although in practical terms this can often be difficult to achieve. Alternatively, these problems can be resolved if formal lectures are used in conjunction with other teaching methods. These may include compulsory reading of the recommended textbooks, detailed handouts, small group teaching and formative assessment [2].

Universities has beginning imposed lecturers to shift from the passive, traditional way of teaching approach, that is the teacher-centred learning (TCL) approach, to an active, student-centred learning (SCL) approach in the teaching and learning at all faculties. To inculcate active learning in the teaching of Mathematics courses can be quite challenging, especially in higher learning institution. Students are expected to have already achieved a certain levels of standards in their mathematical knowledge prior to their entrance into the university. However, the debate about the falling standards in mathematics achievement has produced increasing attention for researchers, parents and education authorities because of the importance of mathematics in all realms of life. In order to study mathematics, students should understand the theories and also memorize the formulae and this can become difficult to the students. In addition, to apply some of the theories and formulae, students need to be able to visualize the big picture of the problems. However, previous studies had shown that one of the reasons why learning mathematics is so difficult is the attitude of the students itself [1].

In promoting students active participations in the teaching and learning process, the new ways of mathematics teaching and learning should be introduced. According to Means, to provide students with opportunities to take a more active role in their learning process, the SCL approach should be applied. The SCL approach encourages active participation among students. Under SCL approach,

students are encouraged to develop their own lenses through which to view the world and be able to argue and defend their view with confidence. This is very important in learning mathematics because students must understand the theories and must know how and when to apply the appropriate formulae to solve the mathematical problems [1].

That is way it's should be very impotent in the SCL role for computer technology in the mathematical education of engineering undergraduates. Lecturers mast taking into account two aspects – the use of teaching packages and the use of packages to carry out complicated mathematical analysis [3].

No one these days would seriously advocate a return to long division or the manual extraction of square roots. The processes involved did not really advance understanding; rather, they were tedious and off-putting. The graduation to four-figure tables was merely a minor reduction in the tedium. The electromechanical machines which "speeded up" lengthy calculations were not seen as a threat to understanding and the slide rule was a necessary evil. The danger with the arrival of the pocket calculator was that it was accompanied by a decline in mental arithmetic; even the most trivial of calculations is now carried out on the calculator. This has led to a loss of appreciation for the order of magnitude in the result of a calculation which is about to be performed. Expedient to use the computer for difficult analysis after the basics have been learned manually [3].

Computational mathematics is important to engineers as it provides the required knowledge to use commercial engineering software intelligently.

The use of Computer Algebra Software (CAS) package in the teaching of engineering mathematics adds a new dimension to the subject. The added value of incorporating computer graphics and animations available in CAS to help students understand intricate maths ideas is unquestionable. The main benefit of CAS is not to replace the didactic lecturer. In fact, most educators use CAS to enhance their lectures. CAS are typically used in a "mathematical laboratory" environment where students are asked to work in teams to solve short assignments designed to

give students a deep understanding of complex but important ideas in mathematics. It has been found by many engineering educators that performing exercises in laboratory sessions provide students with a healthy grasp of complicated mathematics concepts that are of paramount importance to engineering students. Computer Algebra Software (CAS) are computer software packages that can perform analytical maths calculations. All the complicated symbolic manipulation that students learn in high school can now be automated with CAS [4].

Some of the more popular CAS packages are:

- Maple (http://www.maplesoft.com) is math software that combines the world's most powerful math engine with an interface that makes it extremely easy to analyze, explore, visualize, and solve mathematical problems. It help to solve math problems easily and accurately; solve math problems quickly; to solve problems from virtually any branch of mathematics or field that relies on mathematics, such as calculus, algebra, differential equations, statistics, control design, linear algebra, physics, optimization, group theory, differential geometry, signal processing, special functions, number theory, financial modeling, etc.; to gain insight into the problem, solution, data, or concept using a huge variety of customizable 2-D and 3-D plots and animations; to keep problems, solutions, visualizations, and explanations all together in a single, easy-to-follow document, so we don't have to waste time reconstructing our thought processes; to develop complex solutions using a sophisticated programming language designed for mathematics, so our code is shorter, easier to write, easier to debug, and easier to maintain; create interactive applications for us, our students, or our colleagues, without having to be an expert programmer, and share them over the web.
- Mathematica (http://www.wolfram.com/) has defined the state of the art in technical computing – and provided the principal computation environment for millions of innovators, educators, students, and others around the world. Widely admired for both its technical prowess and elegant ease of use, Mathematica provides a single integrated, continually expanding system that

covers the breadth and depth of technical computing – and with Mathematica Online, it is now seamlessly available in the cloud through any web browser, as well as natively on all modern desktop systems. With energetic development and consistent vision for three decades, Mathematica stands alone in a huge range of dimensions, unique in its support for today's technical computing environments and workflows.

- Mathcad (http://www.mathcad.com/) Calculations are the heart of your engineering information. We must be able to find, reuse, and share this important intellectual property. PTC Mathcad has all our engineering notebook's ease-of-use and familiarity - combined with live mathematical notation, units intelligence, and powerful calculation capabilities. This engineering math software allows to present calculations with plots, graphs, text, and images in a single document. Nobody needs specialized skills to understand PTC Mathcad data, and now that our intellectual property has been preserved, we can leverage it for other projects.

- Derive (http://www.chartwellyorke.com/derive.html). Derive was a powerful system for doing symbolic and numeric mathematics on PC. It processed algebraic variables, expressions, equations, functions, vectors, matrices and Boolean expressions like a scientific calculator processes numbers. Problems in the fields of arithmetic, algebra, trigonometry, calculus, linear algebra, and propositional calculus can be solved with the click of the mouse. Make plots of mathematical expressions in two and three dimensions using various coordinate systems. By its seamless integration of numeric, algebraic and graphic capabilities, Derive makes an excellent tool for learning, teaching and doing mathematics.

One other feature of CAS is its ability to provide advanced graphical illustration of complicated mathematical solution. This makes it enormously easier for engineering educators to perform exercises and apply mathematical subject matter to engineering problems. It was found that these entities are especially useful and appropriate for teaching and learning purposes. A study conducted

found that the appropriate use of CAS helps motivate student to learn and understand mathematics. The role of engineering educators is to encourage students to use these tools to understand the full extent of the ability of mathematical models to solve “real-life” engineering problems [4].

Students believed CAS is more appropriately used in the teaching of engineering science subjects, rather than in purely mathematics subject. This finding thus supports the view that CAS is most appropriately used in subjects that incorporates the teaching of mathematics inside an engineering science subject [5].

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