A review of how advanced biomechanics and biotechnologies can be successfully used to inspire and motivate students.

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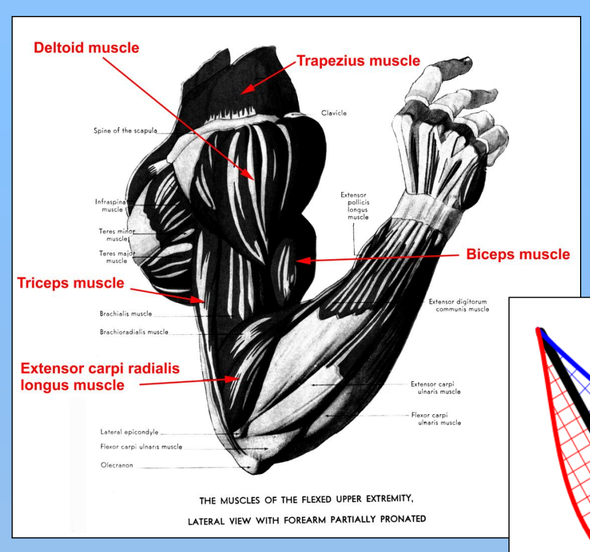
Introduction

The research presented here will illustrate how senior lecturers working in collaboration with a large secondary school in the North West of England have managed to incorporate and introduce the latest advances in biomechanics and biotechnologies into the design and technology curriculum at Key Stage 5 (KS5). Currently this study has only been trialled with a modest number of students (n=9) in a single institution as part of integrating; Science, Technology, Engineering and Mathematics (STEM) into the curriculum as a whole. Results are highly encouraging and show the importance to those in education of diversifying and using real life situations and the latest technologies available to enhance the experience of learners in their charge.

Methodology

Although essentially a piece of action research, the work presented here rapidly evolved into a case study. Working closely with a small cohort of learners and a highly experienced classroom practitioner, students were questioned about the role that STEM plays in everyday life, although many had tacit knowledge of this subject their epistemological ability to verbalise their understanding was initially harder than anticipated. To aid the cohort of students in this study a series of questionnaires and semi structured interviews were undertaken to enable them to reflect on their understanding of the subject in question.

Following the establishment of their baseline level of knowledge KS5 students were given access to a simple anatomical skeleton and asked to reflect on exactly how the skeleton worked in synergy with the muscles to provide movement whilst undertaking the basic ability to perform everyday functions. Using prior knowledge of structures, levers and mechanisms gained in Key Stage 3 (KS3) whilst students were approximately ten to fourteen years of age they were asked to simply model basic sections of the body. Students were split into two groups, one undertook the modelling of an arm and the other a leg. Following this a brief presentation was given by a member of the faculty of health describing in simple clinical terms how the functionality of the limbs in question.



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http://vismod.media.mit.edu
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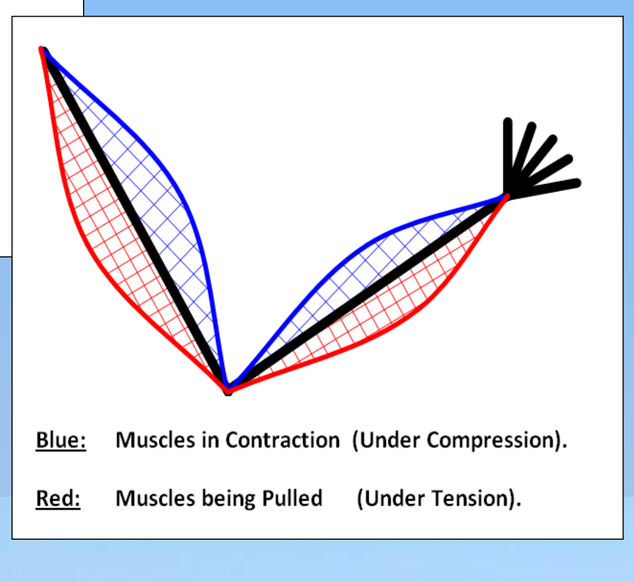
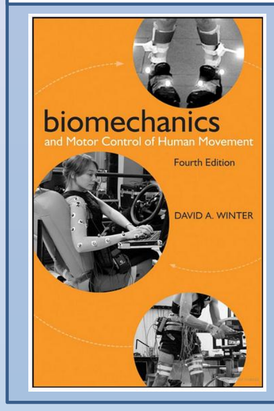
Image Below from Student "A" in research sample
(*male aged 16 years old*).



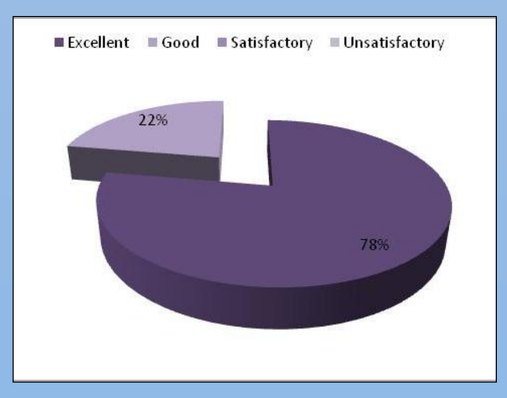
Literature Review



There are many relevant pieces of work into the proposed field of study, Including those of Books by Winter, (2009), Chaffin, et al. (2006) and also Mow and Huiskes (2005). However, these are clinical by nature and definition. There are also a miriad of papers covering all aspects of this work. However, there are no published studies into the epistomological context of how young learners equate simple (and complex) biology and biomechanical concepts into relems appropriate to their level of understanding. There is even less work undertaken into the role STEM has in bringing this to the forefront of technological application in secondary education.

Results and Discussion

Through this work it is clear that students of secondary age struggle with transferable skills between STEM subjects. In particular, it appears that students often fail to relate Technology and Technological advances with Science and Mathematics (the later two they readily combine). As this study is in its infancy, it has been decided to expand the work and focus on the technological impact of artificial limbs and replacement joints. Although more located in biomechanical engineering, technological aspects of this study will encompass tribological relevance of materials, basic metallurgy and all aspects surrounding the use of design as a medium to problem solving – with a focus on ergonomic and anthropometric needs in addition to those of a more clinical nature.



Overall, all students involved in this work rated the experience highly with 78% describing it as excellent and 22% describing it as good. Students felt that they had a better understanding of both basic functions of muscular and skeletal systems, especially in relation to basic mechanical functions in a context more familiar to themselves. They particularly valued the expert input from the health professional who supported this.

Areas of Further Study.

As this study is in its infancy, it has been decided to expand this research study and focus on the technological impact and significance of artificial limbs and replacement joints. Although more located in biomechanical engineering, technological aspects of this study will encompass tribological relevance of materials, basic metallurgy and all aspects surrounding the use of design as a medium to problem solving – with a focus on ergonomic and anthropometric needs in addition to those of a more clinical nature. It is also proposed to expand the study in terms of the number of research participants.

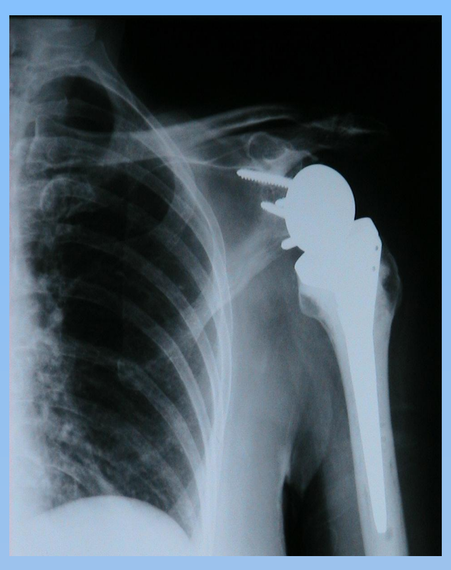


Image above taken from
http://www.trinidadortho.com
Accessed 30th July 2010.

References:

Chaffin D., Andersson G, Martin B J. (2006) *"Occupational Biomechanics"*, 4th Ed., Pub: Wiley-Blackwell, London.

Mow, V., and Huiskes, R., (2005) *"Basic Orthopaedic Biomechanics and Mechano-Biology: A Guide for Massage Therapists"*, 3rd Ed., Pub: Lippincott Williams and Wilkins, London.

Winter, D., (2009) *"Biomechanics and Motor Control of Human Movement"*, 4th Ed., Pub: John Wiley & Sons, London.