

Can we ensure that vocational programmes are at the same 'standard' as general education programmes?

The case of Geometrical and Orthographic Drawing in Malawi Craft

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Abstract

Malawi Craft is a vocational programme that was established to train school leavers in ten technical trades. School leavers who join craft courses may or may not have a background in Geometrical and Orthographic Drawing (G & O). Nevertheless, G & O appears to be a basic component of all the trades under Malawi Craft.

The aim of this paper is two-fold: first, to compare the content of G & O at Senior Secondary School level with that at Malawi Craft level which is a post-secondary. In case of G & O being more at the secondary school level, suggestions will be made for improvement. The first part will end with conducting statistical analysis of comparative performance in college between those who did G & O in school against those who did not.

Secondly, the paper will analyse cut-scores for various grade levels in order to establish whether or not assessment standards have been maintained over the years in subjects where G & O is a component.

Introduction

Malawi Craft is a vocational programme that was established to train school leavers in ten trades namely:

- Motor Vehicle Mechanics,
- Machine Woodworking,
- Mechanical Trades (General Fitting),
- Brick work,
- Carpentry and Joinery,
- Plumbing,
- Welding and Fabrication,
- Vehicle Body Repair,
- Painting and Decorating, and
- Electrical Trades.

In all these trades, students train at craft (elementary) and Advanced Craft levels. Up until 2002, The Malawi Polytechnic used to train students at technician level, a step between Advanced Craft and a Degree level of craft.

School leavers who join craft courses either have a background in Geometrical and Orthographic Drawing (G & O) commonly known as Technical Drawing (TD) or they do not. Nevertheless, TD appears to be a basic component of all the trades.

Research questions

In order to appreciate the bigger question, the title of this paper, TD was used as decider variable for the following specific questions:

1. How much of TD is there at MSCE level?
2. How much of TD is there at Craft level?
3. Do students who did TD at school level perform better in colleges than those who did not?
4. Have grading standards in subjects that have TD component been maintained over the years?
5. How much of TD should be at school and college levels?

Methodology

In order to answer the research questions, desk research and subject matter specialists were used.

The desk research involved analyzing syllabus content of TD at both school and college levels, to which two subject matter specialists established the depth of the TD. Furthermore, multiple regression was done to establish the extent to which grading standards had been maintained from 2002 to 2004 Craft Examinations.

Results

Content Coverage of TD at MSCE level

At MSCE level, TD is examined as a stand-alone subject and it comes in two papers, Paper I and II. A summation of the content in the two papers is the entire syllabus at MSCE level. There also a coursework which constitute 20% of the overall grade. The syllabus aims at:

1. developing student's ability to understand and appreciate good draughtsmanship;
2. developing students' skills in the use of drawing equipment; and
3. developing students' ability to use geometrical constructions and orthographical drawing in producing solutions to practical problems. The syllabus is covered in two years, and specially trains students in basic geometric and orthographic drawing skills in line/letters, basic geometric construction, scales, triangles, circles and parts, quadrilaterals, polygons, tangents to a circle, enlargements, areas, normals, loci, cycloid, helix, parabola, hyperbola, blending radii, construction of an ellipse, pictorial drawing, and orthographic projection.

Content coverage of TD at craft level

The aim of the TD syllabus at craft level is for communication; that is students should be able to read and interpret a working drawing.

As discussed above, TD is a component in almost all the trades at craft level at which candidates sit two papers whose scores are combined with those of practical component. At either craft or advanced craft, there are therefore three components namely:

- Technology,
- Associated paper and
- Practical commonly known as phase tests.

Technology

This component involves sketching and little calculations. The skills assessed in this component include use of materials, site work, way of carrying out certain tasks, etc. In a nutshell, the technology is a paper that assesses the theoretical grounding of a candidate in a particular trade.

Practical

In this component, candidates work on a project. The candidate is assessed on using his/her hands to apply learnt theory.

Associated paper

This paper assesses candidate's skills in Science and TD. The coverage of TD mainly focuses on the applied drawing detail of each trade. The depth varies from trade to trade. Tables 3.2.3 (a-h) has details about TD coverage at advanced level by year and by question for some trades.

Table 1 Carpentry and joinery

Year	Topic	Question number	Marks
2002	Development of surfaces	9	5
2003	Development of surfaces	9	5

2003	Development and showing of details	10	5
2004	Orthographic drawing	9	5
2004	Development and showing of details	10	5

Table 2 Brickwork

Year	Topic	Question number	Marks
2002	Orthographic and Geometrical Drawing hyperbola	7	5
2002-2004	True length, plan of frustum, development of prism	8	5
2002-2004	Setting out of arch, drawing an arch	9	5
2002-2004	Isometric and oblique projection, elliptical arches	10	5

Table 3 Motor vehicle mechanic

Year	Topic	Question number	Marks
2002	Isometric views	10	10
2003	Isometric views	10	10
2004	Isometric views	10	10

Table 4 Machine woodworking

Year	Topic	Question number	Marks
2002	Geometrical	19	4
2002	Freehand drawing	20	4
2002	Orthographic	21	4
2002	Orthographic	22	4
2002	Orthographic	23	4
2002	Development	24	4
2002	Pictorial	25	4
2003	No examinations		
2004	Orthographic	20	8
2004	Development	21	8
2004	Pictorial	22	8

Table 5 Mechanical trade

Year	Topic	Question number	Marks
2002	Orthographical, projection, assembly drawing, Ditto	15	20
2002	Orthographical, projection, assembly drawing, Ditto	16	10
2003	Orthographic drawing, assembly drawing, Ditto	15	10
2003	Orthographic drawing, assembly drawing, Ditto	16	20
2004	Orthographic drawing, assembly drawing, Ditto	15	20
2004	Orthographic drawing, assembly drawing, Ditto	15	20

Table 6 Plumbing

Year	Topic	Question number	Marks
2002, 03, 04	1ST angle	12	5
2002, 03, 04	Surface development	13	5
2002, 03, 04	Hexagon	14	5
2002, 03, 04	Ellipse	15	5

Table 7 Welding and fabrication

Year	Topic	Question number	Marks
2002, 03, 04	1ST angle	1	10
2002, 03, 04	Orthographic	2	10
2002, 03, 04	Development	3	10
2002, 03, 04	Circles, tangents, sectors	4	10

Table 8 Vehicle body repair

Year	Topic	Question number	Marks
2002	Instruments for drawing	5	10
2002	Orthographic, 3rd Angle	1	10
		2	10
		3	10
2003	Isometric view	11	10
2003	Development	12	10
2004	Constructing a Δ	1	3
2004	1st Angle orthographic	2	10
2004	Surface development	3	10
2004	Circle (tangent, chord, segment)	4	3

It would appear that coverage of TD mainly focuses on applied drawing detail of each trade. The depth varies from one trade to another, and is much more detailed than at MSCE. The coverage at MSCE is basic, generalized and spread over many areas.

Looking at Craft within the period under study, item writers and moderators maintained the total number of marks allocated to drawing questions in Carpentry & Joinery, Brickwork, Plumbing and Motor Vehicle Mechanics. However, there were seemingly variations in marks allocation in Machine Woodworking and Mechanical Trade. As for Machine Woodworking, its table of Test Specification shows that the total marks for drawing questions is 20% of the whole Associated paper. The variation in the allocated marks in 2002 and 2004 was +8 and +4 respectively. This shows that the setters and moderators did not follow the table of test Specifications. The same picture could be true of Vehicle Body Repair. There was variation in the marks allocated in 2002, 2003 and 2004 of +2, -5 and -2 respectively.

Statistical comparison in performance between those who did G & O in schools and those who did not

Scores of the first three college tests from three Technical colleges were analysed using T-test, linear regression, and one-way ANOVA. Out of the 50 students in the three colleges, only 5 did G & O in school. Results of T-test for Test 1 between those who did G & O and those who did not in school indicated a mean difference of 1.90 which was significant (i.e. p-value = 0.000) at beta 0.05. The small mean difference was supported by R-value of -0.213 using linear regression. Pearson correlation between scores of the first test in college and those who did G & O gave a p-value of 0.146. That is, the correlation was not significant. Finally, One-way ANOVA between G & O and the three tests showed p-values of 0.146, 0.054 and 0.404 respectively for test one, test two and test three.

Maintenance of assessment standards over the years

In order to establish whether or not assessment standards have been maintained over the years, analysis should ideally be focused on composition and structure of the test papers, and cut-scores over a period of time. Detailed analysis of the past papers was not possible because of technical limitations. However, analysis of cut-scores for associated paper of Brickwork and Carpentry & Joinery at Advanced level was done. The analysis was conducted on 2002 to 2004 examinations. Tables 9 and 10 have more details.

Table 9 Cut-scores for Brickwork

	2002	G-points Difference	2003	G-points Difference	2004
Pass	30	-4	26	+4	30
Credit	50	0	50	0	50
Distinction	65	-1	64	+1	65
Sd	15.404		14.597		13.19

Table 10 Cut-scores for Carpentry & Joinery

	2002	G-points Difference	2003	G-points Difference	2004
Pass	30	+5	35	-10	25
Credit	50	+5	55	-5	50
Distinction	65	0	65	0	65
Sd	10.969		10.905		12.00

Discussion of results

As has been established, TD at school level is basic and generalized because it is the foundation stage. However, it would appear that during the first lectures at Craft level, the school level content is covered because not all learners might have learnt TD in school. This is why there is almost no correlation in performance between those who did TD in school and those who did not going by the results of ANOVA. The first three tests in the three Technical colleges support this assertion. The implication of this scenario is that syllabus coverage in Technical colleges delays because a number of students are just at the beginning level of TD. In turn this may affect the motivation of those who did TD at school level since not much challenging work is not presented to them during the first weeks.

Variations in TD content across the three years under study for Machine Woodworking and Vehicle Body Repair could be attributed to non reference of the existing Table of Test Specifications during test development. This can easily distort assessment standards over the years. The Table of Test Specification indicates that 25% of the total marks of the paper be allocated to Technical Drawing. Again, the possibility is that item setters and moderators did not restrictly adhere to the Table of Test Specifications. In almost all the trades, it seems that a particular question number carries the same topic every year. This could be a sign of a short syllabus. This state of affairs can lead to overtesting of the topics, and hence candidates memorizing or guessing what would come in the examination paper.

Ideally, calculation of confidence intervals on particular cut-score points could help to establish whether or not assessment standards have been maintained over the years. This however was not realistic because of high standard deviations. The high standard deviations reflected diverse performance abilities from one candidate to the other. Probable reasons for this are variations in teacher qualification, high mobility of teachers, inadequate numbers of teachers, laziness in some students, and lack of training of markers, setters and moderators.

Conclusion

Vocational programmes need to be at a higher standard than general educational ones because they are at a higher level of education. However, in Malawi context, such programmes need to start from basics i.e. they should cover what is taught at school level because not every vocational student may have done any foundation course for such a vocational programme. After all, only 13 out of over 700 secondary school centres offer TD.