April 10th, 1968.

Minutes of the Science Faculty Council Meeting - Thursday, 10th April 1968, at 3:40 p.m.; Room 207 Buller Building.

The following (34) members attended: Chairman, Dr. R. D. Connor; Professors: W. G. Barker; J. Reid; H. R. Godavari; F.W.J. Davis; B. D. Macpherson; K. W. Armstrong; R. H. Betts; A. F. Janzen; H. D. Gesser; J. H. Loudfoot; J. B. Westmore; C. M. Wong; T. Schaefer; M. E. Kettner; F. M. Kelly; G. E. Dunn; N.E.R. Campbell; M. J. Oretzki; J. G. Eales; K. W. Stewart; C. C. Lindsey; J.W.T. Dandy; R. Hawirko; D. H. Hall; R. J. Lockhart; B. Noonan; G. O. Losey; N. S. Mendelsohn; Nora Losey; P. K. Isaac; H. Boom; B. R. Irvine; H. Welch.

I. On motion of R. J. Lockhart (B. Noonan) the minutes of the previous meeting were accepted as circulated.

II. The Chairman initiated a discussion with respect to the teaching of Geography 228 as a science option. After a brief discussion centered around the question of a non-science department offering a science course, R. D. Connor pointed out that perhaps this question might await the outcome of the report that should be forthcoming from the committee that had been established to investigate the change of name requested by the Geology Department.

N. E. R. Campbell (J. H. Loudfoot) moved that consideration of Geography 228 as a science requirement course, be deferred until the committee had brought forward a resolution with respect to a change of name of the Geology Department. (Carried without dissent).

III. The Chair noted that the words "and Science" had been removed from the regulation governing University entrance with respect to Grade XI subjects.

IV. The Chair noted, with respect to Item I of the agenda, included by request, that we were perhaps not ready at this point to discuss it because of external decisions that are about to be taken which would bear on it.

M. J. Oretzki (R. Z. Hawirko) moved that item I of the circulated agenda be tabled (unanimous consent).

V. The Chair introduced Item II of the circulated agenda by noting that a committee had been set up (Chairman, K. W. Armstrong; Members - N. S. Mendelsohn and H. R. Coish) to produce a brief for submission to the Mathematical Council of the Manitoba Department of Education (chaired by Dean A. L. Dulmage). The brief was embodied in the circulated agenda.

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Item V. (Cont'd.)

K. W. Armstrong was invited to speak. He noted that algebra has been changed but that geometry has not as yet. He reiterated the points made in the brief, noting that teaching by axioms might well become a practice and a rote and that problem solving was minimized. This would be most unfortunate.

N. S. Mendelsohn supported in general this argument, while M. E. Kettner and M. J. Oretzki made the point that improved mathematical coverage would ease teaching in the Department of Physics.

B. Noonan opposed the method of preparing a brief that was to be submitted from the entire Faculty but which had not been discussed by the Faculty. Referring to a long involvement with committees dealing with high school mathematics, he noted that he was in possession of facts that might make the brief appear naive, certainly incomplete, and somewhat uninformed.

R. D. Connor - this brief was requested by April 1st, 1968. If, however, it does not satisfy the Department of Mathematics, perhaps in spite of the deadline we should not proceed.

K. W. Armstrong suggested that this brief could be forwarded from the committee and not from the faculty.

B. Noonan suggested that we should inform the Mathematics Council that a brief would be forthcoming from the Department of Mathematics and not from the Council at large.

Chairman - It seems that we can proceed in one of two ways:

(1) Forward the report;
(2) Refer the report back to an expanded committee and miss the deadline.

C. C. Lindsey voiced an opinion that expressed the feelings of many Council members - that the brief was one that he was uninformed on and, since there was a diversity of opinion among the informed, he could not support it.

A motion was proposed by M. E. Kettner (F.W.J. Davis) that the Department of Mathematics convene a meeting to discuss this further and that any interested party should communicate with the existing committee so that a more representative brief can be prepared for onward transmission by the Faculty Council (passed without dissenting vote).

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VI. The Chair reported that, on the matter of splitting the Faculty of Arts and Science into a Faculty of Arts and a Faculty of Science, there would be no final report forthcoming prior to the April 30th deadline. The matter was receiving very careful attention and was the subject of an extremely fair evaluation based on a document from Dean Sibley explaining the pros and cons.

The Executive, meeting with the Senate representatives in Arts and Science, had exhaustively discussed the matter and had concluded that at this time it was inadvisable to consider such a split. This had appeared as a motion which had been accepted unanimously.

While not in favour of a split, the augmented executive recognized defects in our present structure and modus operandi and was considering improvements which might lead to a simplification of the organization. The discussions had been most harmonious.

M. J. Oretzki asked the basis of the unanimity that the Faculty be not split.

R. D. Connor proceeded to outline the main points in Dean Sibley's paper and M. J. Oretzki asked if so significant a document could not be circulated. Dr. Connor could see no reason why this should not be done and undertook to request the circulation to the Council.

VII. On motion by G. O. Losey (B. Noonan) the meeting was adjourned (5:30 p.m.).

NOTICE OF MEETING - SCIENCE COUNCIL

MEETING of the SCIENCE COUNCIL, to be held WEDNESDAY, APRIL 10th, 1968, in Room 207, BULLER BUILDING, will be at

3:40 p.m.

Agenda has been forwarded to you previously.

NOTICE OF MEETING - SCIENCE COUNCIL

There will be a meeting of the Science Council, Wednesday, April 10th, 1968 in Room 207 Buller Building.

A G E N D A:

(1) Request from the Deans' Review Committee that consideration be given to extend the basic Arts Group to include classical civilization courses - Icelandic; Italian; Judiac Studies; and Ukrainian.

(2) Consideration of the brief on Mathematical Curricula with a view to its submission to the Department of Education on behalf of the Science Council.

(3) Any other business.

R T Cannon.

SUBMISSION TO

THE COUNCIL FOR DEVELOPMENT OF MATHEMATICAL CURRICULA

by

The Science Council of the University of Manitoba

OBJECTIVES OF HIGH SCHOOL MATHEMATICS

Ideally the student should acquire by the end of high school;

(a) A knowledge of basic algebraic and geometric (synthetic and analytic) techniques.

(b) A reasonable assurance that these techniques are logically and intuitively valid.

(c) The ability to apply these basic techniques to interesting and challenging problems.

(d) The ability to formulate problems from other disciplines in mathematical terms.

In the current program objectives (c) and (d) are almost excluded, particularly in algebra. It is to be noted that objectives (a) and (b) are actually subordinate to (c) and (d). Probably one of the reasons that (c) and (d) have not been attempted is that one can merely indicate standard strategies that might be applicable.

With the above objectives in mind the committee has formulated the following apecific recommendations:

Algebra: The committee was greatly disturbed (indeed horrified) by the overemphasis on formalism in the algebra courses. The professional mathematician uses axiomatics as a tool to make well developed intuitive structures precise. Great caution should be exercised in using this highly technical device for pedagogical purposes. There seems to be no value, for example, in dwelling on the commutative and associative principles which are intuitively automatic. On the other hand the distributive principle can be usefully exploited to justify such statements as $a0 = 0$, $(-a)(-b) = ab$, etc. These principles can be utilized but should not be fossilized into such barbarities as LDPMA, MPZ, etc.

It is recommended that formal axiomatics be markedly de-emphasized particularly in the grade IX course. The use of quantifiers should be discontinued since they simply serve to confuse the student. Chapters 1, 2, and 3 of Vance reflect this spirit. Accelerating the rate at which the formal algebra is covered should permit the treatment of topics in which the basic principles are applied. Such topics are systems of equations (nonlinear), inequalities, complex numbers, and theory of equations. All these are in the current grade XI text.

Geometry: High school students do not have sufficient mathematical maturity for the study of strict axiomatic synthetic geometry (Hilbert's axioms). It is even clearer in the case of geometry that axioms are technical devices which were introduced in order to make intuitive proofs rigorous. The student should first know the intuitive structure well before being asked to understand why certain axioms are required.

In considering the Birkhoff approach the following observations were

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made. Geometry has been the only part of high school mathematics in which students have had contact with methods similar to those used in higher mathematics. It has also been the only part of the program that has had any challenge for the good student. In the Birkhoff approach these advantages are lost.

The committee thus recommends the retention of intuitive synthetic geometry. The committee does not advocate the complete ommission of axiomatic structure but cautions that axioms should be used to aid intuition, not destroy it. If possible, a better text in classical Euclidean geometry should be found.

Grade XII Program: Analytic trigonometry should be completely covered in grade XII. Chapter 19 of Vance offers excellent examples of applications of analytic trigonometry. It would also be of use in physics.

In addition, if any of the topics, systems of nonlinear equations, inequalities, complex numbers, and theory of equations have not been covered in grade XI, they should be completed. One of the major difficulties in first year physics and mathematics courses at the university has been the inability of students to solve nonlinear systems of equations.

The function concept should be presented in terms of mappings, correspondences, rules, etc. The ordered pair definition should be considered secondary or even ommitted. Possibly the introduction of the function concept should be postponed until one can illustrate where the concept can be used. Such areas are analytic trigonometry, exponential and logarithmic functions. The graphing of functions should be emphasized.

It would be of great aid to the teachers if a handbook such as that provided for grades 1 - 6 were provided for the other grades.

Many of the above observations are more fully explicated in the following references.

[1] The Role of Axiomatics and Problem Solving in Mathematics. - The Conference Board of the Mathematical Sciences. Ginn and Co.

[2[Alexander Wittenberg, Sampling a Mathematical Sample Text, Amer. Math. Monthly, 70 (1963) 452 - 459