

Indicators of Creative Ability in Craft Students

John T Fisher
Shoreditch College

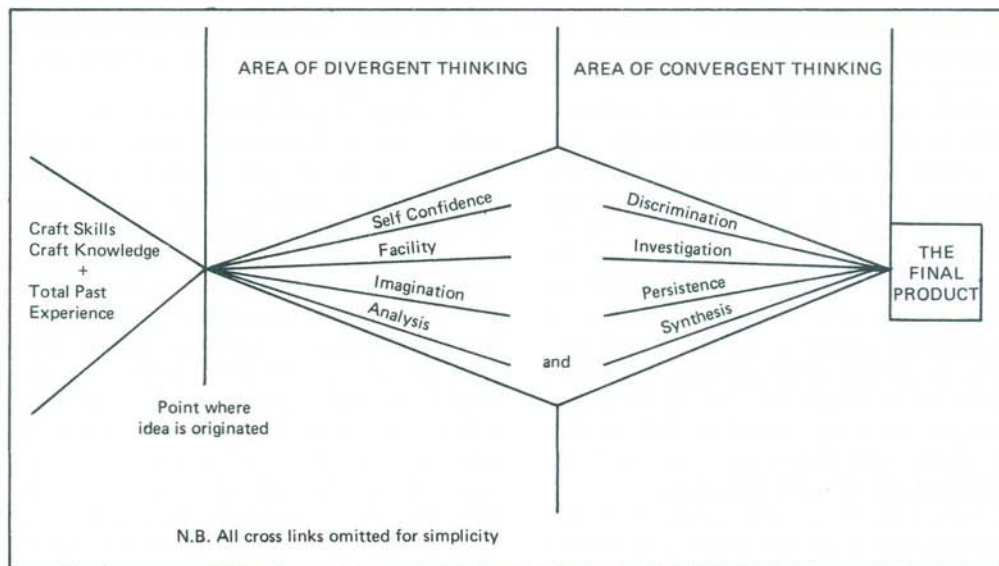
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After considerable research into the work of previous investigators in the field it became obvious that very little work had been done specifically relating to Craft Education. Furthermore, almost all the previous researchers had investigated the total concept of creativity or large numbers of the abilities supposed to be necessary to a creative person. This writer evolved a theory of the Creative Process which is expressed by the diagram below.

This illustrates the complexity of the process. There are possibly many other elements which could be included and, of course, the dimensions of the area of divergent thinking and of the area of convergent thinking may vary with each individual. It seemed realistic to start at the beginning where, it may be seen, the ability to diverge

from an idea appears fundamental. If the concept is correct, creative people will be seen to diverge more effectively than persons of low creative ability.

Nevertheless, from the diagram it will be seen that it is held that, at one point, an individual forms an idea. When this idea is originated it may not be original or novel to that individual or to anyone else. It may be a very pedestrian idea but, however good or bad it is, is less important than what happens to it. If it is held in the mind and not communicated to others, not developed or used, it remains abstract and passes away without influence. In a comparable way to the Design Process, the Creative Process requires an end-product, and this permits us to see that it has taken place. If the originated idea is produced in concrete



terms, which in craft subjects would result in the making of an object, something has been created. If, however, the idea is simply produced directly with no development or consideration and was possibly very pedestrian in the beginning, the end-product will demonstrate a very low level of creativity.

Such an example would be represented on my diagram as a straight line passing through to the end. For example, therefore, if one visualised a stool, probably one seen in the recent past experience, and simply duplicated it without further thought, it might possibly demonstrate high craft skill or knowledge, if one had these attributes, but not high creative ability. Yet the stool would have been created in the dictionary sense of 'bring into being'. It follows, therefore, that every individual must be creative to some degree, however low that may be. It seems to me unlikely that an individual with such unquestioning monolinear thought processes would have originated a completely original or novel idea in the first place.

In comparison another individual, who perhaps originates the same idea as in the first example, might consider how this stool will suit his needs and take into account: the place where it is to be used, the person who is to use it, the materials from which it may be made and a variety of ways of making it. Even these few considerations would result in a wide variety of shapes, sizes, colours, textures, and so on. This individual diverges from the first idea and, depending on his analysis of the situation, his imagination, the ease with which he can look at different but related ideas and his self confidence in approaching something which may be quite novel or at least more complex, produces a variety of developments. This is the area of divergent thinking marked on the diagram. Its width and extent will vary with the individual and the idea originated.

Having arrived at the variety described, the individual must now begin to investigate his possibilities, discriminate and synthesize

from a variety of parts to organise his production. He needs also persistence to effectively carry through the work. Craft skill and knowledge will play a part here too, but are less limiting with an individual who, if some skill is lacking, will take it into account and modify his ideas accordingly. This whole area of thought is represented on the diagram as one of convergent thinking because the object of a simple creative process is to produce one most effective result, not a complex compound of the workable and the useless. Once again, the width and the extent of this area will vary with each individual and the idea under consideration.

Tests of creative ability

An attempt was made to determine whether tests could be used to distinguish the highly creative craft pupils from the ones of low creative ability. It was also decided that the administration of the tests must be in the hands of teachers. This possibly implied that any significant results obtained would be all the more valuable because administration in ideal conditions with unlimited time by experts might produce even more significant results.

A sample of 580 children was eventually tested over a three-week period by craft teachers in 36 schools situated in various parts of the country. The sample was selected from the A/B stream of the third-year craft students by the teachers. Each teacher involved was known to be carrying out work which encouraged the problem-solving approach to craft and offered subjects for testing. The pupils selected for the Highly Creative Group were those who consistently produced ideas and solved the problems regardless of their craft skill and each teacher might have had one or two such boys who were clearly distinguishable. In a large school there may have been some in wood-based craft and some in metal-based

craft. The teacher also selected an equal number of boys from the same form who did not exhibit these abilities. Thus one school might have tested six boys while one large comprehensive might have tested as many as forty. Small sub-samples were offered by some schools and a number of subjects were tested from C/D streams third year, from A/B streams second year, from A/B and C/D streams fourth year.

The test battery was divided into three sections for ease of administration. Booklet A, which took an hour to administer, contained: (a) two sheets, one of small household tools, such as fish slice or spanner, and another of more complex tools such as lawn mower or sewing machine. These tests had been used by Dr Fitzpatrick of Manchester University to indicate past experience of craft pupils. (b) A 'dot squares test' where the subject has to add two dots in any position and join them all to produce as many different patterns or objects as possible. This was originated in 1922* by Simpson and indicates Figural Divergence. It was scored for number of responses and for changes of set. (c) Orthographic Test 1 originated by B Maycock, in which front and plan views of an object were given on squared paper and as many alternative end views as could be visualised were required. (d) Orthographic Test 2 was similar to No.1 except that a front and end view was given. These tests should indicate ability in Spatial Relationships.

Booklet B, which also took an hour to administer, contained:

- (a) The Alternative Uses Test, used by many researchers, where five stimulus words are given and the subject produces as many alternative uses for each as he can. The three tests (a) (b) (c) are hypothesized as indicating Ideational Fluency.

- (b) Patterns Test, again used by many researchers, in which eight patterns are provided as stimuli and the subject is required to give as many open-ended responses as he is able.

- (c) Lines Test is similar to (b) except that the stimulus cards show a continuous line instead of a pattern.

- (d) A Verbal Test similar to the ones used by Thurstone where the subject is required to produce as many words as he can beginning with the letter 'T'.

- (e) A Verbal Test where the subject is required to produce as many words as he can which mean the same as 'CUT'. Both (d) and (e) are tests of Verbal Fluency and were included to determine the effect of this particular ability on other test results.

- (f) Matches Test, where a number of identical patterns were laid out in squares and the subject marks with a cross two 'matches' in each pattern as those to be removed yet to still leave a pattern all composed of complete squares. This test indicates Adaptive Flexibility and Spatial Relationships ability or, as J P Guilford prefers to call it, *the Divergent Production of Figural Transformations*.

The third booklet is the standard A H 4 intelligence test which requires ten minutes to administer each half plus practice time. Each school also completed a pro-forma questionnaire listing routine information and also data relevant to the testing, e.g., No. of students wood-based, years of technical drawing, etc.

Results and analysis

Having amassed the scores on all the tests for all the pupils tested the information relating to the amount of T/D the pupil had done, the type of course he had followed in craft, and so on, was codified and this added to the list of variables to be considered.

* SIMPSON, R M, 1922, 'Creative Imagination', *American Journal of Psychology*, Vol.33, pp 234-243.

As soon as half the total data was available, it was necessary to check that the tests had, in fact, distinguished between the two groups. All the tests had been scored by the writer and the data was subjected to the statistic $\sqrt{\frac{s_1^2}{n_1} - \frac{s_2^2}{n_2}} = S$.

This showed that all tests did distinguish the Highly Creative Group from the Less Creative Group, well beyond the 1% level. That is, these tests distinguish between the two groups so well that this result would be

likely to be obtained by chance less than once in every hundred times such data were collected.

Because there were so many variables which could affect the scores, the data for the total sample of 446 was then subjected to a Principal Components Analysis. This produced significant factors which were then rotated to a Varimax and an oblique (Promax) solution, the latter allowing the correlation of the factors to be shown.

		<i>Intercorrelations Between 2nd Order Factors</i>			
	1	.999	.070	.187	— .285
	2	.070	.999	— .128	.073
	3	.187	— .128	.999	— .199
	4	— .285	.073	— .199	.999
<i>Factor Pattern for Total Sample</i>					
<i>Variables</i>		<i>Factor Pattern on 2nd Order</i>			
: : Test	14				.706
Tools 'A'	12				.466
Patterns Test	19	— .405			.229
Orthographic Test 1	16	— .347	.294		.254
Tools 'B'	13		— .225		.385
'Cut' Test (Verbal)	22	— .337	— .280		.291
: : Changes of Set	15	— .504	.174	.295	.323
Alternative Uses	18	— .512		— .180	.154
Matches Test	23	— .403		.384	
Orthographic Test 2	17	— .349	.245		
Lines Test	20	— .554	.154		
'T' Test (Verbal)	21	— .498	— .352		
Part 1 AH4	24	— .732	— .166		— .206
Total AH4	26	— .818			— .161
Part 2 AH4	25	— .739			
		Factor 1	Factor 2	Factor 3	Factor 4

The Factor patterns for the total sample were produced and, when it became evident that patterns could be produced, it was decided to carry out two other analyses, one for the Highly Creative Group data and one for the Less Creative Group data, separately. In these tables, shown for the groups separately, the patterns are clearly seen because the data from one group does not obscure the other.

The differences between the patterns for the two groups are interesting. In the

analysis for the 'Highly Creative' group it may be seen that Factor 1 is bi-polar with loadings from AH4 (the intelligence test) at the negative pole. The AH4 test makes the greatest contribution in Factor 3. The continuum of Factor 1 is clearly delineated with high loadings and appears largely distinct from 'g', at least as far as general intelligence is measured by the AH4. Each of the remaining factors in this pattern have associations with the general ability test. If we examine the abilities which have contributed

		<i>Intercorrelations Between 2nd Order Factors</i>			
	1	.999	— .067	— .085	.266
	2	— .067	.999	.179	.199
	3	— .085	.179	.999	.059
	4	.266	.199	.059	.999
<i>Variable</i>		<i>Highly Creative Group Factor Pattern on 2nd Order</i>			
Patterns Test	19	.665			
Tools 'A'	12	.312			
Tools 'B'	13	.348			
:: Changes of Set	15	.390			— .403
Lines Test	20	.683			— .285
Alternative Uses	18	.564	— .161		
'Cut' Test (Verbal)	22	.271	— .585		
:: Test	14	.212	— .448		
Part 2 AH4	25	— .207	— .267	— .410	— .358
Total AH4	26	— .194	— .306	— .415	— .395
Part 1 AH4	24		— .278	— .319	— .343
Orthographic Test 2	17		.205	— .605	— .291
'T' Test (Verbal)	21		— .671		
Orthographic Test 1	16			— .626	
Matches Test	23			— .592	
		Factor 1	Factor 2	Factor 3	Factor 4

most to Factor¹— for example, the Patterns Test, Lines Test and Alternative Uses Test — these are all hypothesized as indicating Ideational Fluency with loadings of .665, .683 and .564 respectively, while the Dot Squares test with a loading of .212 and the changes of set with .390 are hypothesized as indicating Figural Divergence. The ability to draw upon previous experience of tools has loadings of .348 and .312. The Divergent Production of Semantic Association (associational fluency verbal) has a loading of .271.

The pattern for the Low Creative Group shows a very different picture. In this pattern Factor 1 is clearly the one which represents general ability. Factor 3 is the important one here because it groups loadings entirely separate from any indication of general intelligence as measured by the AH4.

There are only three factors to be seen in the second order pattern for the Less Creative Group where four were found for both the High Creative Group and for the Total Sample. It is particularly noticeable also that all the loadings for this Less Creative Group are positive. It is not surprising therefore to find that these factors do not lie in the same areas as those for the other groupings.

In this Pattern, Factor 1 is clearly the one which represents 'g'. The loadings relating to the Cognition of figural classes are high at .615, .622 and .697 (AH4) that for the Divergent Production of Semantic classes (Ideational Fluency, Divergence) is .753 while Ideational Fluency, divergence is .650 and .559. The two Verbal Fluency measures (Divergent Production of Symbolic Units and Divergent Production of Semantic relations) are seen with .490 and .406.

Factor 2 does not show any particular characteristic except that it includes the major portion of the loadings concerned with the Past Experience Tests at .431 and .358.

Factor 3 is the most important of this Pattern because it appears to group loadings

entirely separate from any indication of general intelligence as measured by the AH4. This heavily loaded Specific Factor groups: Divergent Production of Figural Systems .545, the Divergent Production of Figural Units (figural fluency): the ability to produce many simple figures that conform to given specifications, .541 and .309, Divergent Production of Figural Transformations (adaptive flexibility, spatial relationships) .434. Only this last loading appears in either factors 1 or 2.

To recapitulate; both factor patterns, for the Highly Creative Group, and that for the Less Creative Group, show factors which appear to be largely or wholly independent of the general intelligence factor. There is, however, a considerable difference between the two groups, because these factors are not the same in each case. For the Highly Creative Group they are: Ideational Fluency, Divergent Production of Semantic Classes, Figural Divergence and Past Experience. For the Less Creative Group they are: Figural Divergence, Spatial Relationships and Adaptive Flexibility.

Conclusions

It will be seen that a main difference from the factor patterns is that Ideational Fluency plays a very important part in the mental make up of the Highly Creative boys and ability in Spatial Relationships in that of the Low Creative. This may indicate the real difference between the two groups and also suggest the need for different methods of presentation of teaching material. Part of the reason why members of the less Creative Group are not outstanding in their ability to solve problems and produce creative practical solutions in craftwork may be that these problems are at present usually seen or developed in the abstract. If the problem is structured in terms of direct experimentation with materials the ability in Spatial

<i>Intercorrelations Between 2nd Order Factors</i>				
	1	.999	.041	.433
	2	.041	.999	.116
	3	.433	.116	.999
<i>Factor Pattern for Low Creative Group</i>				
<i>Variable</i>		<i>Factor Pattern on 2nd Order</i>		
:: Changes of Set	15	.602		.266
:: Test	14			.545
Orthographic Test 1	16			.541
Orthographic Test 2	17			.309
Matches Test	23	.222		.434
'Cut' Test (Verbal)	22	.406	.189	.228
Tools 'A'	12	.262	.358	
Tools 'B'	13	.271	.431	
Part 1 AH4	24	.615	.156	
Total AH4	26	.697	.160	
Alternative Uses	18	.753		
'T' Test (Verbal)	21	.490		
Patterns Test	19	.559		
Lines Test	20	.650		
Part 2 AH4	25	.622		
		Factor 1	Factor 2	Factor 3

Relationships of these boys may then be more available to produce creative solutions. Their ability in Figural Divergence and Adaptive Flexibility would reinforce the possibility of success when the situation may be examined by the manipulation of material.

The members of the H C group, however, are able to relate their Past Experience of tools and through their ability in the Divergent Production of Semantic Classes, can more readily express the developments pro-

duced by their ability of Ideational Fluency. In addition, they too have the ability in Figural Divergence which facilitates this expression, or at least the effective consideration of it. Inevitably the member of the H C group will excel because the divergence and variety possible with high Ideational Fluency must be greater, probably quicker, and therefore more effective.

A consideration of these abilities seen in these two groups of boys suggests that differences in both material and presentation

will be appropriate in their craftwork, the problems they are set and the educational experiences in which they should be involved.

A number of variables were taken into account in the study in addition to those already mentioned and further work was carried out on the data. A two-way Analysis of Variance with unequal numbers in cells was programmed. The following variables were shown to have no significant effect upon the results:

- 1 the order in which the three test booklets were administered;
- 2 the School year of the subject, ie, 2nd, 3rd or 4th;
- 3 the Stream of the subject, ie, A/B or C/D;
- 4 whether the School streamed its pupils or not;
- 5 the type of course followed by the subject, eg, wood-based craft, metal-based craft, integrated course.

This suggests the tests may be used effectively to distinguish pupils over a wide range of age or ability groups and in all craft situations.

Three variables were shown to have had a significant effect:

- 1 The School Type. Subjects were drawn from six types of School. The figures suggest that all boys both H C and L C in Grammar Schools achieved higher scores than boys in all other types but further tests and new data would be required to determine why this is so.
- 2 The School Size. Four sizes of school were used and the variance ratio for this item falls exactly on the 5% level.
- 3 The amount of T/D. All subjects were coded according to whether they had studied T/D for 1 year or 2 years or not at all. The figures suggest that this significance is largely due to subjects who had studied T/D for 1 year

and, again, further tests and new data would be required to determine why this is so.

Since the completion of this investigation, further work has been carried out with adults as subjects. It has been found after considerable investigation and comparison of case histories that the battery is effective as an indicator of adults who are required to be creative in the work they do.

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