

The Self Rating of the student in his answer to the question whether he had produced anything creative, correlated highly with the predictor tests. This rating refers to products rather than person, and this has the effect of increasing its value as criterion measure.

(ii) Intelligence and Creativity

The finding that intelligence did correlate significantly with four of the predictors and with three of the criterion measures indicates a relationship between intelligence and creativity in this sample. However, since all subjects, perhaps with the exception of three (C.M. score = above 100) had IQ's below the 120 mark, Barron's (1961) summary of research findings holds true, i.e. that beyond an IQ of about 120 there is no relationship between creativity and intelligence. In our study if we look at the 5 people with the highest intelligence score (C.M. = 97-125) and compare these subjects with their place in their total predictor score we note the following: the person with the highest intelligence score took 10th place with his total predictor score; the second highest in intelligence ranked highest in total predictor score; the third highest on intelligence was 35th in predictor score; the fourth highest took 7th place in total predictor score, and the fifth highest in intelligence took 22nd place in his total predictor score. All these people belong in the H.C. group which is made up of the

53 highest total scorers on creativity predictors. Their intelligence score shows a relation to their predictor score. The total predictor score of the H.C.'s correlated with intelligence, as measured by the Concept Mastery Test, and was significant at the 5% level.

It has been demonstrated (p. 171) that the H.C. sample obtained an intelligence score of about 17 points higher than the L.C. sample and that the difference between the groups was significant at the 1% level. This again indicates that some relationship does exist between intelligence and creativity. However, the intelligence scores had a very wide range from its lower limits to 125 with a mean of 49. It is therefore expected that some relationship between intelligence and divergent thinking or creative abilities was found in this sample of subjects which is more representative of the general population than students who are further advanced in their study.

The relationship which was found in this sample between predictors verbal creativity and intelligence suggests that these tests measure both convergent and divergent thinking.

(iii) Testing of Hypotheses

Six hypotheses related to creativity, personality and other variables were proposed and tested. Findings are reported in the different sections of the previous chapter. For the convenience of the reader the obtained results are summarized and discussed briefly below, and methods employed in testing these hypotheses are evaluated.

HYPOTHESIS I: Field-dependent subjects are less creative than field-independent subjects.

The dimensions of field-dependence/field-independence were measured by means of the 2 tests: Gottschaldt Figures and Pattern Relations, and the positive relationship obtained in the main correlation matrix between these two tests and the predictors and criterion measures of creativity, support this hypothesis (Table XV). Further, if we look at the total score for field-dependence/field-independence we note that the difference between the H.C. group and the L.C. group on this factor was significant above the 1% level. As mentioned before, there was some theoretical support for this hypothesis, but little experimental evidence to date (p.56).

The two measures of field-dependence/field-independence are highly correlated with each other, suggesting that they measure the same dimensions. There is also a positive correlation at the 1% level of significance with the factor of spatial creativity as measured by the tests: Making Symmetric Designs and Common Elements.

Therefore, the assumption that the relatively high-level organization and personal differentiation which characterizes the functioning of the field-independent person and the vague, blurred and labile mode of functioning which can be found in the field-dependent persons was demonstrated in the students' creativity test scores.

HYPOTHESIS II: Highly motivated students are more creative than less motivated students.

Motivation was measured by three tests: the Fear of Failure scale, a component of the Famous Sayings test; the newly

developed Work Attitude Scale and the Continuous Coded Addition, a continuous work test. These three tests correlated significantly with each other leading to the acceptance of the assumption that they measure the same factor. However, they do not correlate with creativity predictors and/or criteria. In comparing the factor of motivation between the H.C. and L.C. group it was found that no significant differences existed between the two groups.

The hypothesis is therefore not confirmed. Besides this, motivation did not correlate with academic success. The author believes that the measurement of motivation is rather complicated and includes factors and variables which differ in each individual from situation to situation. Perhaps the maturity of the individual and whether a particular motivation is a short term or a long term motivation may give us the answer. Even a willing student who has himself chosen his field of study and who might even finance it himself may resist learning. We could compare the concept of resistance (to improvement or to learning) with that of the inertia of organisms, were it not for the fact that often the student's resistance to learning in the school situation is by no means hampered by inertia in other areas. The roles of learner and the non-learner may be reversed outside the school. Moreover, individuals can be found who offer no resistance to learning, who learn difficult, uninteresting material, even when it is poorly presented; such a person may learn when his personal life is so "fouled up", that others would be unable to continue. Extreme as this may appear, it raises the problems of motivation

in learning and also in creative production and of those variables which aid or harm the performance. It should be realized that motivation is still very much a field of exploration where instruments of measurement may be chosen more on the basis of personal preference than on validity. MacKinnon (1962b, p.37) mentions that "creative architects, like architects in general, are strongly motivated to achieve in situations in which independence in thought and action are called for (Ai). But, unlike their colleagues, they are less inclined to strive for achievement in settings where conforming behavior is expected or required". However, there is a great difference between MacKinnon's study and this study. His study deals with mature practising architects and the present one with first-year architecture students. His study is a validation study and this study is of an exploratory nature. MacKinnon knows that the creative architect must be highly motivated to achieve in his field. In this study motivation is not certain and achievement can only be gauged as the passing of examinations. Therefore, the measurement of motivation has to be seen in a different light, and the study must be based on the assumption that drive, perseverance and fear of failure are the motivational aspects which need to be investigated. It appears that students who do not have enough drive and perseverance are not likely to finish their course.

HYPOTHESIS III: Creative architecture students display more "normal" anxiety than less creative students.

Chapter II and III discuss some of the experimental and theoretical implications of the relationship between anxiety and creativity. The scores obtained on the Preconscious Activity Scale correlated significantly with the Taylor Manifest Anxiety Scale but not with the other 5 creativity measures. The hypothesis is therefore only partially supported. If we look at the difference in anxiety scores between the H.C. group and the L.C. group we notice no further support for the hypothesis; the difference between the two groups was not significant.

It has been suggested in chapter II and III that anxiety is also a motivation factor of non-linear nature, however, this was not pointed out in the results, in our case anxiety was related negatively to motivation. The assumption that low anxiety is related to moderate intensity of motivation and high anxiety to extremely high intensity of motivation or drive has also not been borne out in our study. However, the anxiety measure shows a positive relationship to hostility, dogmatism, and intelligence. There is no relationship in this sample between anxiety and academic success, but a positive correlation (5% level) with the students' Self-Rating Scale is shown.

HYPOTHESIS IV: Highly creative architecture students have greater facility for visualization than less creative students.

In chapter III it was suggested that the closest measurable approximation to visualization were the two newly constructed tests Making Symmetric Designs and Common Elements. These two tests correlated with each other and with some of the creativity predictors and criteria. There is also a relationship between the tests for visualization and the two tests utilized for field-dependence/field-independence. If we look at the total score of visualization we note that the difference between the H.C. group and the L.C. group on this factor was significant above the 1% level. The hypothesis as such was supported.

Another point of interest is the fact that there is a relationship between the measure of intelligence and one of the tests of visualization, namely, the Making Symmetric Designs. It appears that both, Making Symmetric Designs and Common Elements are useful tools in the search for a measurement of visualization. One of the greatest advantages which the two instruments have is the easy scoring procedure.

HYPOTHESIS V: Less creative architecture students are more dogmatic than creative architecture students.

The significant differences obtained between the H.C. group and the L.C. group on the measure of dogmatism, supports the fifth hypothesis (Table XXVII). The measure for dogmatism was Rokeach's Dogmatism Scale. If we look at the main correlation matrix (Table XV) we note the high negative correlation

between some of the creativity tests, creativity criteria and dogmatism. This is further support for the hypothesis because an increase in creativity score brings with it a decline in dogmatism.

Dogmatism is only one of the factors which belong to the dimension of openness to experience. Other measures are Hostility, Conventional Mores and Social Aquiescence, all components of the Famous Sayings test.

The measure of Hostility shows no relationship between any of the creativity indicators. The other two factors, Conventional Mores and Social Aquiescence are negatively correlated with creativity indicators, and intelligence. The openness-closeness to experience dimension, in other words our four measures, Dogmatism, Hostility, Conventional Mores and Social Aquiescence are all related to each other in this sample, this is borne out by the high intercorrelation between the measures, and this seems to support the assumption that a person who is dogmatic and closed to experience is not creative, but nevertheless appears to be highly motivated.

HYPOTHESIS VI: Academic achievement in students of architecture is related positively to creative ability.

The section on academic achievement in chapter II and III gave us conflicting evidence about the relationship between academic achievement and creativity. There is no direct study which tries to demonstrate a relationship between academic achievement and creativity in architecture students. Only one study mentions that students who chose the more difficult approach

had more academic success.

Academic achievement was measured through the final grades which students received after completion of their first year of study at the university. The hypothesis was not supported because there was absolutely no relationship between final grades and creativity.

Further, the difference in frequency between the four parts of the Teacher's Rating Scale for the H.C.'s and the L.C.'s was not significant.

(Table XXIV).

At a closer look we note the relationship between Final Examination Grades and Rated Spatial Expression which indicates that in order to pass his main subjects, the student has to be judged by his lecturer as being able to express himself creatively in his drawings. Also his Final Examination Grades show no relationship with his Self-Rating.

(iv) Theoretical Implications

It is interesting to consider to what extent the findings of the present study support or contradict earlier findings about the nature of creativity in the architect, the architecture student and the creative individual. A closer analysis is made of these in chapter I and in chapter II. We now look at these sections to establish whether our research supports past findings or not.

Our sample consisted of first year students of architecture. At this stage it is hard to predict what will happen to students after a graduation which is four years away.

The study has pointed out that academic success and creativity are not related at this stage. The first year is known for its high failure rate. Here those with low intelligence, low talent, lack of motivation or maturity are weeded out. The second year student may change the picture and show that, as far as architecture students are concerned, academic success and creativity might well be related. Only after graduation can it be shown whether the successful architect really possesses all the qualities and talents attributed to him. Such an assumption can only be supported or rejected after a longitudinal study similar to that of Terman (1956).

MacKinnon (1962b, p.38) and associates found that the characteristics of the highly creative architect are "his high level of effective intelligence, his openness to experience, his freedom from petty restraints and impoverishing inhibitions, his aesthetic sensitivity, his cognitive flexibility, his independence in thought and action, his high level of energy, and his unceasing striving for creative solutions to the ever more difficult architectural problems which he constantly sets for himself". This study rejects none of the findings of MacKinnon. On the contrary, it gives further support to the findings that the highly creative person has to have a high level of effective intelligence, is open to experience and has cognitive flexibility. Again, we have to keep in mind that the first year student is still a long way from a successful architecture career.

If we are interested in the creative individual as shown in chapter II we have to remember that none of the

factors which make up the accepted personality profile of the creative person could be rejected. The experiment proved that the highly creative architecture student was high on social maturity, liberalism, open to experience, non-authoritarianism and had a tolerance of ambiguity. Other personality dimensions, also not investigated in our study, appear to be present in our sample. As chapter II demonstrates, we are seeing the creative individual as somewhat withdrawn, quiescent, with some element of protest present in his inter-action with others, few friends, little interest in people but more interest in objects and ideas, not rebellious, willing to follow the lead of parents without losing too much of his independence and initiative, cooperative, friendly and accepting other people at what they are.

If we look at the process of creativity we have to accept that the stages of preparation, incubation, illumination and verification are all part of this process, but these stages have to be seen as a gestalt. These stages do not follow necessarily in a particular order and can appear all at the same time. Creativity can be divided into several parts. Our study contributes to the theory of creativity in that it shows that creativity consists of several dimensions, and that the most important of these dimensions appear, at least for architecture students, to be the dimensions of verbal, spatial, personality and art appreciation. However, the last of these, art appreciation seems to be somewhat doubtful, because of its low correlation with the criterion and other predictors.

In testing hypotheses, data emerge of the creative individual. Hypothesis I, suggested that field-independent subjects II provides details about field-independent creativity. A person's orientation in space person's orientation in life in general. demonstrated that the perceptual function independence and field-dependence in human behavior meaningful and coherent fashion to general aspects of cognitive functioning which include intellectual, social, motivational, and emotional of the person. This research supports the relation to creativity. As shown, field-independent have several personality factors which characterize creative persons. This does not mean that all persons are also creative. However, the person shows the kind of autonomy and freedom and restraints which could be seen as a new encounter. The creative individual demonstrates richness of his inner experience and an interest in his environment; he is able to "break up" concepts and to arrange them in new combinations. The importance of field-independence for creativity is established.

To measure motivation appears to require experimentation in this direction may be exploratory in nature. It is axiomatic that a creative person has to be motivated in order to

However, a person can have creative potential (which is what we really tried to measure) and not be motivated to produce. This might be the reason that Hypothesis II, that highly motivated students are more creative than less motivated students, was inconclusive. Creative production and creative potential are not the same. Besides, it appears, that we were able to measure maximum performance in the test situation, and not motivation as expressed in the application to school tasks.

It may be assumed that a certain amount of anxiety is necessary if one is to be productive, but if the level of anxiety is too high and the task becomes more complicated, productivity suffers. It would appear that if cases of very low or very high anxiety go to university, they risk failure there, because if anxiety is very low people appear to have little interest in improving themselves and if it is too high, tension produced by test situations may well prove too much for them. Hypothesis III was not supported in that creative students display no more "normal" anxiety than less creative students. This finding gives no support to the evidence indicating a direct relationship between anxiety and creativity.

In our study the field of research was expanded by including the factor of visualization, and in indicating that visualization is important to creativity (Hypothesis IV). The process of creativity is not completely understood. The reason for this is perhaps that the ingredient of visualization has been neglected. This short-coming has been taken care of. As mentioned before in chapter II, visualization does not take place in every human being, as mistakenly assumed by highly creative people like Faraday, Kekule, and Einstein (Walkup, 1965 and Hadamard 1954).

As it agreed with the general findings, Hypothesis V suggested that creativity and openness to experience correlate. Dogmatism, hostility and conformity are negative aspects of personality development and so hinder creativity.

The conflicting evidence regarding the relationship between academic achievement and creativity could not be mitigated in our study (Hypothesis VI). No relationship was found between creativity and academic achievement. MacKinnon (1962b, p. 31.) mentions that "in school and college the creative architects were tolerably good students, but in general not outstanding if one may judge from their academic grades". In other words they passed their course work so that they could qualify. However, the subjects of this study were not architects, but first-year architecture students and in this may lie the explanation. Motivation and maturity may still be lacking in many of the able students. As Self-Ratings demonstrate; students know their ability and talents but in many instances are not motivated to apply themselves.

To sum up, the picture of the creative individual has been expanded through this investigation but no revolutionary conclusions can be drawn. None of the previous theoretical assumptions has been overthrown. The study served to support previous findings and extend them. The creative individual emerges as intelligent, open to experience and with cognitive flexibility. What has now been brought to light is the importance of field-independence and visualization. Creativity is also seen as divisible into several new dimensions.

(v) The General Aim

The aim of this study was not only to make an attempt to develop tools with which to predict and measure the psychological profile of students of architecture and to test a set

of hypotheses, but also to assess the predictive value of a battery of tests in distinguishing between:

1. high and low creativity level in students of architecture;
2. success and failure level in students of architecture.

The tests used were expected to provide personality profiles typical of the two creativity levels and/or of the success or failure levels. The practical aim was to condense the existing battery of tests into a tool for predicting the creativity potential of aspiring architecture students.

1. The high and low creativity level in students of architecture has been determined by the total score on the creativity tests. A multiple regression analysis was done with personality variables and total predictor score. Results are shown in Table XXIX. They suggest that the highly creative person has a low score on Social Aquiescence, a high score on Gottschaldt Figures and on the MAS, a low score on Dogmatism, a high score on Fear of Failure, Work Attitude, Pattern Relations, and Hostility, and a low score on Conventional Mores. These results are significant in the order mentioned. The three best tests on the personality level for predicting the highly creative individual are the Social Aquiescence Scale of the Famous Sayings test, Gottschaldt Figures and the Taylor Manifest Anxiety Scale. All three scales are significant at 0.05 level or better.

2. Success or Failure level in the sample was measured by the final examination grades. Every effort to show the profile of the successful or unsuccessful student was disappointing. The only test that correlated significantly with academic

success was the Gottschaldt Figures, but this could also be due to chance, since the correlation was at the 5% level of significance and only 33% of all students passed the final examinations. A multiple regression analysis was run with personality variables and academic success. Results are shown in Table XXX. They are disappointing but suggest that the measures of field-dependence/field-independence show promise in predicting academic success. This leads us to the assumption that the successful student is more field-independent than the failing student. According to the regression analysis the three best tests on the personal level for predicting academic successful students of architecture are Gottschaldt Figures, Pattern Relations, and the Taylor Manifest Anxiety Scale. The last one of these instruments is not significant at the 0.05 level.

If we want to carry our assumption one step further we could combine the findings of 1. and 2. We could then assume that a student's chances to be both highly creative and successful in the field of architecture will be good if he has a low score on Social Aquiescence and a high score on Gottschaldt Figures, on Pattern Relations and on the MAS. If our assumption is correct then the failure rate could be considerably reduced by applying the above tests, or similar tests for selection purposes.

(vi) Definition of Creativity for Architecture

Various concepts and definitions of creativity have been discussed in the first two chapters. The author's definition incorporates some of these ideas which he believes

distinguish creativity from other processes. The emphasis is, however, on creativity in architects and /or in architecture students:

"Creativity is one of many human capacities by which man is able to produce something new, novel or original and that serves to fill a gap in a particular area. Creativity is influenced by a multitude of factors and can be divided into at least four dimensions, personality, verbal and spatial creativity and appreciation. The degree of creativity in a particular field is the magnitude of the effect that this product has on this field".

All in all the findings of the present study seem to support this definition. If we look at the word "capacity" we have to assume that creativity involves many divergent-thinking abilities, such as originality, sensitivity to problems and perhaps others. Here we have the problem-solver and the problem-finder; a person can be one or the other and in a few cases both.

Test measures of creative abilities demonstrate some relationship with the intelligence measuring. It appears that the verbal creativity tests show this relationship, measure both convergent and divergent thinking. However, a significant relationship exists between the predictors of creativity and with the external criteria of creativity. All in all we have to agree with Guilford, who believes that creativity is mainly determined by specific cognitive abilities, and that the difference in creative ability is determined by quantitative differences of these cognitive abilities. Guilford believes

that these abilities can be measured. Further, it has been demonstrated that creative abilities go hand in hand with personality dimensions.

Creativity can be divided into several overlapping dimensions. Architecture is in a unique position to show the fact that creativity can be divided. In other words, a successful architect can be seen as a creative architect. He must not only be creative on the drawing board, but also be able to communicate successfully, that is orally and in writing with other people in different positions and settings. Besides this he has to be able to appreciate beautiful buildings in order to be able to delight the eye and show firmness and usefulness in his creative production. This is why the predictors have been divided into verbal, spatial, personality and art appreciation dimensions of creativity. Similarly, the Teacher's Rating Scale as a criterion was divided into, a) Rating Spatial Expression, b) Rating Spoken Expression, c) Rating Written Expression and d) Successful Interpersonal Contact, to judge the abovementioned dimensions. We have to keep in mind that in the architect's profession, as in no other occupation, we can expect to find the most general characteristics of the creative individual.

An individual can have creative abilities but if he has little or no motivation (and/or a certain amount of maturity), his talents are wasted. Only through creative production can the individual be judged, and he is judged higher if his creative product fills a gap in a particular field. The higher the need for the product, the greater will be the value

and the credit. Creative individuals and/or problem solvers, they need

B. Overall Evaluation

The study of creativity over the last decade, one of the most active fields, has produced a large amount of experimental data which is relatively immune to scientific criticism. For this purpose, the problem of defining the point of being insoluble as the basis for an ever widening field of definition. In efforts to explain creativity in terms of a theoretical conception of creativity, conflicting experimental findings for different populations and particular theories may be inadequate in others. Perhaps the factor analytic approach to creativity which led Guilford (1959 & 1966) to conclude that creativity is not one, but there are many types of creativity, each which might be measured in a different population. Some creative dimensions are stronger in creative production than others, and this leads to specialization in some dimensions and performance. The task of the experimenter is to identify the most important factors in creative production.

The author made no attempt

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This study is part of a continuing finding tools for measuring divergent or for better predictors of performance in college depend on such ways of thinking. The traditional university performance, that is, high school of verbal and quantitative aptitude, have been better estimating success in English, mathematics courses than they have in music, fine arts. For this reason, the battery of tests has been based on the predictive effectiveness of creativity and associated personality factors in order to determine which architects had judged were related to success in school.

Architecture students were chosen on the grounds that the successful architecture students manifest those personality factors which are characteristic of a creative individual. Behind this thinking is the idea that if an architect's designs are to be successful, the architect must be an artist, and if they are to be technically sound and efficiently planned, he must be at least an applied scientist or engineer. Therefore, an architect has not only to be both artist and

also if he is to be successful in his occupation, he must to some extent be businessman, advertiser, author-journalist, lawyer, educator, psychiatrist and psychologist.

The overall assessment of the present exploratory investigation has to be made in the light of the state of current research on creativity, with a particular emphasis of creativity in architecture students. Not much work has been done with creativity in architecture and what has been done was initiated in the United States. Of particular importance here is the study completed by Mackinnon (1962a & b) which has been discussed in chapter I. Further research which influenced our study has been thoroughly discussed in chapter II.

The author chose to explore a number of areas of creativity, rather than concentrate only on a single aspect and to study the relationship between creativity as a whole in relation to personality and other variables. An attempt was made to construct effective predictors for spatial creativity. A number of criterion measures were devised in order to provide evidence of validity for all creativity predictors used. Certain hypotheses about the creative first year student of architecture were tested and these were intended to throw light on aspects of the creative process and yield some information about the personality profile of the creative student that might predispose him toward innovative behaviour.

In the previous chapter it was demonstrated that the obtained results have been promising. Experimental evidence has thrown more light on the currently neglected subject of the

creative process and on the personality profile of the architecture student.

The author hopes that this exploratory study will help to stimulate further interest in creativity research among architecture students so that a still better method may be devised to select future architecture students. We find factors involved which are influential in the creative process and its prediction.

Architecture although in the best position to solve the riddle between creativity and academic success has not come up with an answer, in other words, the creative architectural potential has not been fully understood. The answer lies that we need to measure potential more fully, relying on traditional measures of achievement. We find students who start on the study of architecture at a university may have widely differing backgrounds. If we have measured the individual's potential we should know if he will use this potential, in other words, his motivation and maturity to make the best of his opportunity. It is far too simple in judging a person on his high school record and so turn away the wrong student or deny him his opportunities. The right answers to solve the problem will not be easy and might be far into the future.

C. SUGGESTIONS FOR FURTHER RESEARCH

The field of creativity is a complex one and the need for research is immense. We have to realize that creativity is important for the future well-being of mankind.

understanding and control of the creative performances. The solutions to a multitude of human problems are dependent on the education and training of the present and future populations of the world. The elite at least, if not all intelligent people, should be creative and problem - solving people, because only by an expanded education can this planet be kept from a threatened disaster.

Schmidt (1969 pp.18-20) in Research in Creativity --- 1965-1968 --- A Bibliography and Analysis, makes suggestions for further research in creativity. He puts the main stress on teaching creativity and in the co-operation of researchers and educators to work together in testing and formulating recent findings on teaching and learning. The partnership of both teacher and researcher is necessary and fruitful, because the teacher knows the student, subject and school better, while the researcher has the necessary theoretical constructs, experimental design and his special vocabulary for investigating a particular educational phenomenon. Further research in creativity could therefore be as follows:

(i) There could be more studies of creative and non-creative teachers. There are few teachers who help the creative students. The majority do not know how to help, or do not care. There is also an extremely large group of teachers suppressing or killing creative abilities in pupils. Research is needed in this realm, if only to restore a lost communication.

(ii) There is a need to develop systematically a category system to analyse classroom discourse. This system could include

logical operations, like hypothesizing, inferring, and generalizing; or psychological elements like degree of motivation, self image, participation in discussion and interaction with teachers. It could also be either issue-centered or value centered.

(iii) If the statement that creativity or genius is "ninety percent perspiration and one percent inspiration" is true, then to ignore research into the relationship between creativity, perseverance and motivation would be serious.

(iv) More research is needed in group or classroom discussions. We know what teachers and students, heads of department and research workers ought to do, but very little of what they are actually doing. Through observations, tapes, and video tapes of these meetings this could be corrected.

(v) Longitudinal studies of creative individuals, and perhaps groups, would be desirable. Research could concentrate on how the personality is affected by a non-directive, inquiry-centered approach and what transfer value this approach would have for later years. Motivation could be explored in terms of the Hawthorne effect, to see whether the novelty of the approach accounts for differences in interest and participation.

(vi) It would be desirable if more data, concerning personality, intelligence, socio-economic and ethnic background would be available about the individual who participated in studies of creativity. Relationships between personal and social variables of the subjects have to be established.

Intellectual performance and motivation to learn something new are important factors to be considered.

(vii) The relationship between creativity needs further research. If further research finding that there is only a slight relationship between creativity and intelligence then perhaps with general intelligence or I.Q. tests by supplying items requiring creative or divergent thinking.

(viii) No experimental work appears to be establishing whether there are in fact two creative abilities. We could assume that a distinction between the inventor and the theoretician, solver and the problem finder.

(ix) There is a need to focus more direction of knowledge in the different disciplines. Research may move in the direction of care between concepts and methods of investigation in science and of studying their overlapping psychological elements should be found in research should be harmonized.

(x) There is need for experimenting with curriculum organization and sequence. The difference made between graded and non-graded schools. In a non-graded school the students have several options in learning without too much stress and without rigid rewards and punishments. Certainly these methods will work only if the student has reached a certain maturity.

(xi) It has been demonstrated that the social environment appears to influence the creativity.

individual. Investigations could be conducted in school, universities and research institutes to clarify what factors really affect the creative individual. The emphasis could be on interpersonal conduct, such as the relationship between teacher and student and/or team leader and young scientists. Since it is of interest for the school or university or for the research institute directors to know how to manage best their creative individuals, it is likely that they would show their co-operation to such research.

(xii) If we are interested in creativity as a whole, future investigations will most likely take two major directions: to find a better understanding of the creative process, and to note conditions that influence creativity.

We have to use the best method of producing conditions for influencing creativity. An important source of determination of creative thinking lies in the area of motivation. We have to find the needs, interests, and attitudes that help the individual to be creative productive, and the blocks that inhibit this process. Future research has to find answers to the following question: How do certain attitudes and emotions affect various stages in the complete creative process? When answers are found to this question the foundation will have been laid for an increased control of the creative process;

CHAPTER VIII

SUMMARY

(1) Two tests were designed to measure spatial creative ability for this study. Four other tests of creativity were chosen from a number of well established instruments. For the two newly developed tests the nature of the items, scoring methods, and time limits, were decided on after numerous preliminary investigations, including several pilot studies.

The final battery of tests, and the factors of creativity which they are intended to measure are as follows:

Spatial Creativity

Making Symmetric Designs - Subjects are given a booklet and strips of black paper which can be dissected into three parts, and are asked to make as many symmetric geometric figures of their own using one strip of paper for each.

Common Elements - Subjects are requested to judge which of the common elements are present in each pair of the abstract - complex geometrical figures.

Verbal Creativity

Seeing Faults - Three descriptions of solutions to problems are given. Subjects are required to name faults or weaknesses in the proposed solutions.

Consequences - Subjects are presented with hypothetical and unlikely occurrences, and are required to

respond with possible consequences of such occurrences.

Creativity as a Personality Dimension

Preconscious Activity Scale - Subjects are required to classify 38 statements as either true or false.

Art Appreciation

Barron-Welsh Art Scale - Subjects are presented with 86 figures which they have to score as like or dislike.

The tests of verbal creativity are tests devised or adapted by Shapiro; the Preconscious Activity Scale was developed by Holland and Baird in the U.S.A. The Barron Welsh Art Scale is also an American test. The two tests on spatial creativity were originated and constructed by the investigator.

(ii) A number of instruments were employed to measure personality and related variables in their relationship to creativity dimensions. One of the instruments used to test motivation, the Work Attitude Scale, was designed and constructed by the author. Another instrument, the Famous Sayings test, which consists of four personality measures was adapted to South African conditions by the investigator. The nature of the items, scoring methods and time limits, were decided after numerous preliminary investigations, including a pilot study on 338 college of education students.

The final battery of tests and the factors of personality and related dimensions which they are intended to measure are as follows:

Field-Independence/Field-Dependence

Gottschaldt Figures - Subjects are required to find one of five

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simple figures in 45 complex figures.

Pattern Relations - Subjects are asked to find a missing part in each of the 30 patterns given to them in a booklet.

Intelligence

Terman Concept Mastery- This intelligence test consists of two parts; in Part I subject has to identify synonyms and antonyms; and in Part II he has to complete analogies.

Motivation and Anxiety

Continuous Coded Addition - In this continuous work test subjects are required to exert themselves for over an hour in adding simple figures.

Work Attitude Scale - Subjects are asked to classify 38 statements as either true or false.

Fear of Failure - Subjects have to classify proverbs or famous sayings into like, don't know, or dislike.

Taylor's Manifest Anxiety Scale - Subjects are asked to answer as true or false 28 personal statements.

Dogmatism and Hostility

Rokeach's Dogmatism Scale - Subjects are required to mark 40 statements indicating the extent to which they agree or disagree with them.

Hostility Scale - Subjects had to classify proverbs or famous sayings into "like", "don't know", or "dislike".

The Hostility and the Fear of Failure scale belong to the Famous

Sayings test which was adopted by the author to local conditions. The Work Attitude Scale was also designed and constructed by the investigator for this experiment and included in a pilot study of 33 architecture students.

(iii) Six hypotheses were proposed and tested:

- (a) That field-dependent subjects are less creative than field-independent subjects.
- (b) That highly motivated subjects are more creative than less motivated subjects.
- (c) That creative subjects display more "normal" anxiety than less creative subjects.
- (d) That highly creative subjects have a greater facility for visualization than less creative subjects.
- (e) That less creative subjects are more dogmatic than creative subjects.
- (f) That academic achievement in students of architecture is related positively to creative ability.

A Biographical Questionnaire was also given to each student to complete in order to give the experimenter as much personal data as possible. This questionnaire also included two criterion measures on creativity.

(iv) Seven criterion measures were employed, four of which belonged to the Teacher's Rating Scale. These four ratings are: (a) Spatial Expression; (b) Spoken Expression; (c) Written Expression; and (d) Successful Interpersonal Contact. However it was not possible to rate all students on (b) and (c) since the composition of the courses taken by the student did not give the teacher enough contact

in certain areas and therefore not enough information to make judgements in some areas.

Another criterion measure was academic achievement, in other words a combination of all grades received on the final end of the year examination. Since the four groups of students did not all take the same courses a method of assessing their final results equally had to be found. For this reason the person who failed all, or nearly all, courses, that is with the exception of one received a grade of 0.0; the student who passed some courses, but not all, received a grade of 0.5 and the individual who passed all courses received a grade of 1.0.

The Biographical Questionnaire had also two self-rating criterion measures. In the first, which we called Creative Production, each subject was asked to name everything what he had produced which could be considered original, novel or creative. If the subject did not mention anything he was given a grade of 0, for one object or one category he received a 1, and for many creations he received the grade of 2.

The other criterion measure from the Biographical Questionnaire was another self rating measure. The student was asked to rate himself on a four step scale of creativity and of intelligence.

(v) The final sample consisted of 105 first year students of architecture. Nearly all of the students were male and their ages ranged from 17 - 26 years, with a mean age of 19.89 years and a S.D. of 1.6. At the beginning of the study all students who were registered as first year students in the department of architecture were included in the study, but the number was reduced from 117 to 105 because students left the university. In all cases except

three, students left because they were unsuccessful in their course work. Since testing took place through the whole academic year complete data could thus only be gathered on 105 students.

(vi) The following steps were taken in the statistical treatment of the results:

(a) Scores on all variables were intercorrelated, and a matrix of these intercorrelations was drawn up. It was demonstrated that scores on the predictor tests intercorrelated positively, in some cases at a high level of significance. Scores on the criterion measures also intercorrelated significantly, some of the measures correlating positively and others negatively. Five of the criterion measures correlated significantly with at least some of the predictors. The Teacher's Rating of Spoken Expression intercorrelated highly with four of the predictors. Academic achievement as measured by Final Examination Grades did not correlate with the predictors. However, the Self-Rating of the student correlated with four of the predictors.

Age, Sex, Religion, Home Language, Parents' Job and Military Service showed little or no relationship with the predictors, criteria or most of the other variables. Intelligence scores correlated significantly with nearly all predictors and with two criterion measures. The high relationship between intelligence and creativity test scores may in part be attributed to the fact that the sample represents a group of subjects who are not too much above the average population in intelligence, with a mean intelligent score similar to that of the general matriculated population. The intelligence level of the group is below the IQ level of 120, and

at this level intelligence does influence creativity.

(b) Total predictor scores were obtained by adding the standard scores of the predictors. The 105 subjects were ranked on the basis of their total scores. The 53 top and 52 bottom ranked students were identified as a high and low creative group respectively.

An analysis was made of the scores achieved on each of the variables measured in order to identify those items that vary most strongly between the high creative subjects (H.C.'s) and the low creative subjects (L.C.'s). Chi-squares were computed to test the significance of the differences in the number of H.C.'s and L.C.'s rated on several variables. Those items on both Teacher's and Self Ratings significantly differentiating the H.C.'s from the L.C.'s were assumed to be those which most strongly differentiate the two groups. Furthermore, the two groups were compared on other variables through the computation of t-tests, in order to find the significant differences between the H.C. and the L.C. group. Thus it was demonstrated that the H.C. subjects are significantly greater producers of larger numbers of original objects, are more intelligent, facilitate more visualization, are less dogmatic and more field-independent than the L.C. subjects.

In addition to Final Examination Grades and personality variables, two other criterion measures were administered. The teacher was asked to rate the student in the four areas of creativity necessary to a successful architect and one section of the Biographical Questionnaire required students to rate themselves on how creative they thought themselves to be. Ratings made for the H.C.'s and the L.C.'s were compared by means of chi-square.

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The biographical criterion was successful

in that significantly more L.C.'s rated themselves low on both creativity and intelligence than did the H.C.'s.

(c) The six hypotheses mentioned in (iii) above were tested by comparing the H.C. and the L.C. groups. Hypothesis I was supported, high correlations between the measures of creativity and field-dependence/field-independence point in the direction of there being a relationship between the measures. Hypothesis II has not been borne out. No significant differences were found between the H.C.'s and the L.C.'s, as their motivation test scores showed. Hypothesis III was not supported, i.e., H.C.'s expressed no more normal anxiety than L.C.'s. Hypothesis IV was also supported since the H.C.'s expressed significantly greater facility for visualization than did the L.C.'s. Hypothesis V, that less creative subjects are more dogmatic than creative subjects, was supported. However, the last hypothesis was not supported with respect to academic achievement and its relationship to creativity in students of architecture.

(d) Multiple regression analysis were carried out to assess the predictive value of the battery of tests in distinguishing between the high creative individual and the low creative individual on the one hand and the successful architecture student and his failing counterpart on the other hand.

The following profile emerges for the high creative architecture student in comparison with the low creative one according to levels of significance: low score on Social Acquiescence, high score on Field-independence (Gotteschaldt Figures), and Anxiety (MAS), low score on Dogmatism, high score on Motivation (Fear of Failure and

Work Attitude Scale), Field-Independence (Pattern Relations) and Hostility and a low score on Conventional Mores. The three best tests on the personality level for predicting the highly creative individual are the Social Acquiescence Scale of the Famous Sayings test, Gottschaldt Figures and the Taylor Manifest Anxiety Scale.

The profile of the successful student of architecture is of low significance and thus rather disappointing. The multiple regression analysis suggests that the academically successful student has a high score on field-independence. The three best tests for predicting academic success in students of architecture are Gottschaldt Figures, Pattern Relations and Taylor Manifest Anxiety Scale.

According to the step by step multiple regression analysis of individual creativity tests against creativity criteria the least promising test is the Common Elements and the most promising is the Preconscious Activity Scale.

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