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AN INVESTIGATION INTO THE CONCEPTS INFLUENCING THE DEVELOPMENT OF CREATIVITY

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INTRODUCTION

Creativity and creativeness are terms that have become "buzz" words in the last number of years. The term creative is used to describe many works and innovations in the arts and sciences that incorporate some element of difference, novelty or uniqueness. But where have we gained our understanding of creativity from? And more importantly, is it accurate? Many eminent authors and leading psychologists have tried to address the problems of defining creativity and assessing levels of creative thoughts and actions with varying levels of success. But so far, the concept of creativity has refused to fit into any "box".

Over the last forty years, people like de Bono, Guilford, and MacKinnon, have done extensive investigation and research on the subject, which will be studied in detail in this dissertation. Their results are often contradictory, and leave the reader uncertain as to who is giving the more accurate conclusion. The answer to this dilemma is of course, that it is totally up to each individual to personally decide on which argument or opinion (if any), is the correct one.

In this paper, I will be reviewing the relevant literature on the subject, investigating key concepts which need to be addressed, and attempting to simplify some of the psychological rhetoric into a more comprehensive and easily digestible language for the average "lay" person with an interest in the subject. I will also be looking into areas which I feel are of importance in the ongoing debate on creativity such as, the nature, nurture question, gender differences, the creative process and creativity and divergent thinking.

The last section of this paper, will deal with the relationship between creativity and intelligence. I hope to investigate this theory in the classroom and come up with some concrete conclusions, which will be drawn from my own personal observations, plus the findings of established creativity tests, which will hopefully produce a positive correlation.

CHAPTER 1

TOWARDS A DEFINITION OF CREATIVITY

In this chapter my objective is to investigate definitions of creativity by various psychologists and educationalists, to analyse each of them and to compare and contrast them in terms of their similarity (or otherwise), content and relevance to the classroom in the art situation. By carrying out this investigation, I hope to arrive at an acceptable and comprehensive working definition of creativity.

Many leading minds in the field of educational psychology have given their own definitions of creativity. One such expert is Howard Gardner, who states

> ".... the creative individual is a person who regularly solves problems, fashions products, or defines new questions in a domain, in a way that is initially considered novel, but that ultimately becomes accepted in a particular cultural setting." (1)

What he is emphasising here, is the importance of the uniqueness and originality of the creative person in their approach to problem solving. Most of his opinions and hypotheses favour the encouragement of divergent thinkers, as these are the people who think in a way that is "initially considered novel."

As divergent thinkers are often also high intellectual achievers, they usually become part of a peer group or hierarchy in the educational system who set down the standards that others further down the ladder (the convergent thinkers) follow. This would seem to give validity and

credence to Gardner's statement that the novel approach of the creative individual, while initially awesome and new, eventually with time becomes an accepted and respected solution to the problem posed.

Rollo May defines creativity in a very concise statement

> "Creativity is the process of bringing something new into being." (2)

Here we see a very simplistic attempt to define creativity. This statement could be attributed to the creative process in any context, from space age scientific investigation and exploration, to the wonderfully uninhibited shapes and forms in children's pre-school paintings. When May uses the term "new" in this statement, does he mean new as in something that is totally unique, and never before been conceived of, or does he mean a novel approach to a recognised and traditional method of dealing with a design problem? His definition poses a question, but leaves us wondering about a possible answer. Did he make this statement hastily and without much predetermined thought, or did he leave it open ended in order to provoke thought and contemplation on the part of the reader? The answer to this we can only guess at.

Viktor Lowenfeld, who has written extensively on the creative process, gives a definition of creativity which would fit somewhere around level three or four of Taylor's hierarchy of creativity. Lowenfeld states

> "Usually creativity is thought of as being constructive, productive behaviour that can be seen in action or accomplishment. It does not have to be a unique phenomenon in the world, but it does have to be basically a contribution from the individual." (3)

This definition is probably the one that most second level art students would aspire to and actually be successful in. As students move into the senior school at secondary level, they have achieved an understanding of the basics in art. I think that creativity at this stage is the ability to use what knowledge and understanding they have as a springboard to bring their ideas to a higher level of individuality. Therefore, I think that Lowenfeld's definition of creativity is one that sets an achievable goal and is a very appropriate definition for use in the art room at second level.

Carl Rogers, a well known author in the field of educational psychology, states that his definition of the creative process is

> " ..... that it is the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people or circumstances of his/her life on the other hand." (4)

In comparing this definition, with that of Gardner, and also some of the other educational psychologists I will make reference to further on in this chapter, one word is surfacing again and again in the quotations on creativity, and that is the word "novel". All these authors referred to a novel approach to problem solving, and a novel way of looking at product design etc. The word itself suggests something new and unique, but has been given many connotations by the various authors I have studied. In some cases it means a completely original view of an approach to a situation. A process or idea that has never been used before. However, in other cases, it means no more than a slightly different means of approaching something that has been investigated before.

These thoughts suggest questions about the concept of creativity. What do we accept as being "creative"? One researcher in the field of creativity, Brewster Ghiselin, argues for two levels of creativity (5)

(1) Higher Level of Creativity.

The creation of an object for the first time. The act must be entirely original. A unique contribution to the arts, sciences, philosophy or some other area. A "spiritual increment". Few persons attain creativity at this level.

(2) Lower Level of Creativity.

Creativity at this level casts a new light on something already in existence. It improves, alters, or reproduces something. The creation of products of the mind which are novel in that they lie outside the individual's past experience (but cannot be attributed to the higher level of creativity).

Ghiselin's higher level of creativity is one that would be reached only by extremely original and gifted people like renowned scientists, architects, artists, etc. It would very rarely, if ever, be attained by a student in the classroom (unless one was dealing with extremely gifted students). This then puts the majority of society into the category that represents the lower level of creativity. I feel personally that creativity cannot be classified in such a black and white way.

Irving Taylor has proposed five levels of creativity ranging from the simplest to the most advanced. I feel that this is a far more gratifying hierarchy of creativeness than Ghiselin's, as many people would be

accredited for their levels of creativeness that fluctuate below the highest echelon of creative thought. Taylor's levels are

(1) Expressive - as exemplified by imaginative play which may show little or no skill or originality but is an independent expression of the individual concerned.

(2) Productive - for example, games, crafts, and so forth, where some control or technique is involved.

(3) Inventure - showing originality and flexibility, not merely initiative.

(4) Innovative - embodying a significant departure from the conventional in art or science.

(5) Emergentative - that is, discovery of an entirely new and fundamental principle.

When looking back at Roger's definition of creativity, one sees another aspect in the debate on creativity surfacing, and that is the social and economic background of the creative individual, and the part that it plays in the development of their potential for original thoughts and actions. Relevant to this argument also, is the nature/nurture debate. These points are very important in placing the creative process in context, and will be dealt with later on in this paper.

While reading through the numerous and varied definitions of creativity that have been proposed by many leading educational psychologists, I

have been attempting to formulate my own working definition of creativity. On reflection, I suggest a symbolic definition rather than a scientific one. It is a definition that relates specifically to my input as an art teacher and the way in which I would like to influence and foster creativity in the art room.

The symbols would be that of a stone being cast into a clear calm lake of water. The stone would create many ripples that would continue to enlarge and expand in every direction. The art teacher is the stone, making the first few ripples which would be symbolic of feeding the bones of an idea, or the basics, to a student. The ever expanding ripples would be the development of the idea in many different directions by the creative thought processes of the students. In conclusion therefore, creativity in the context of the art room may be described as follows

> "Creativity is the ability to make ripples on the water."

FOOTNOTES CHAPTER 1

1. Gardner, H., "*Creating minds, an anatomy of creativity*". (New York: Harper Collins, 1993).

2. May, R., from "*The concept of creativity in science and art*". Dutton, D.; Krauz, M. (eds) (The Hague : Martinus Nijhoff, 1981).

3. Lowenfeld, V., "*Creative and mental growth*". (U.S.A. : Macmillan, 1982).

4. Rogers, C., 'Towards a theory of creativity' in *Creativity : Selected Readings*, Vernon, P.E. (ed) (Harmondsworth, Middlesex : Penguin Books, 1970).

5. Ghiselin, B., "*Scientific creativity : Its recognition and development*". Taylor, C.W.; Barton, F. (eds). (New York : John Wiley, 1963).

6. Taylor, I., 'The nature of creative process', described and quoted in "*Psychology and Education of Gifted Children.*" Vernon, Adamson and Vernon (eds) (1966).

CHAPTER 2
THE NATURE, NURTURE DEBATE IN CREATIVITY

The common notion of hereditary or genetic factors versus environmental factors is much oversimplified. The genes do indeed provide for the transmission of hereditary qualities, but they do not determine an individual's height, or intelligence, or creativity. They are predispositions, whose effects develop differently in different environments; that is, they interact with environmental conditions or experiences and produce not a fixed effect, but a certain "range of reaction". Nature and nurture are not opposing factors but are complimentary. Sometimes also, the genes control or modify the environment, as when a highly intelligent child shapes his own environment by choosing books to read and other intellectual activities.

Many different types of evidence and research regarding the nature/nurture debate may be referred to in this investigation. None of these are conclucive, but some are more favourable to genetic and others to environmental factors. At this stage, I will endeavour to investigate the possibility of

(1) Genetic, and

(2) Environmental

factors influencing some well known creative geniuses.

Many persons who are generally accepted as geniuses differ so remarkably from the norms as to seem inexplicable in terms of favourable environment. Clearly this applies to Mozart, who was not only performing music brilliantly by the age of six but was also composing. Mozart did grow up in a highly musical environment, indeed under

excessive pressure from his father, but his superiority was far greater than that found in other musicians who had equally stimulating environments. Mozart, by himself provides proof that genetic differences in creativity do exist.

Another compelling example is Leonardo da Vinci. Even though his artistic talents doubtless owed much to a favourable environment and good training, his equally outstanding scientific genius owed nothing to those same circumstances as his scientific prowess was totally self-initiated and self-developed.

Madame Marie Curie and Sophie Germain are very exceptional since so few women have specialised in physics or mathematics. The latter was almost wholly self-taught, and had no parental encouragement. An English girl, Ruth Lawrence, attracted much attention in the late 80's, because at age thirteen, she had surpassed all other mathematics students at Oxford University. She did, however, receive much help from her parents and schools.

Youthful prodigies appear to be much more rare in the literary and visual arts. One such prodigy was Salvador Dali, the much renowned surrealist artist. From a very young age, he showed exceptional artistic talent, and was producing excellent landscapes and self-portraits by the age of ten years. His huge ambition and very well known precociousness is summed up in a well known quotation about his young life

> "At the age of six, I wanted to be a cook; at seven I wanted to be Napoleon. My ambitions have been growing ever since." (Dali)

Pablo Picasso also, showed exceptional talent as a child with extremely advanced drawing ability for his young years. In fact, he once told an art critic that at six years of age he could draw with the reasoning and ability of an adult, but it took him the rest of his career to learn how to draw like a child.

Consistency of Creativity from Childhood to Adulthood.

On the analogy of human physical characteristics, such as height or hair colouring, which are known to be very largely genetically determined and are remarkably stable throughout most of life, one might expect mental characteristics, such as intelligence or creativity to show considerable stability from early to later years, if they too, depend on genetic factors. But there are many difficulties. Often the genes do not manifest their full effects until puberty. Certainly, measures of intelligence show big fluctuations from infancy until later childhood, though they are fairly high correlations between twelve year olds and early adult I.Q.'s, and even more consistency from then on until old age. Gruber (1) (1974) states that

> "..... no link has been demonstrated between giftedness in childhood and creative genius in adulthood ...."

He says that we can hardly expect high creativity to manifest itself much before age twenty, because creative scientists and artists have to acquire a great deal of knowledge and skills to be creative within the adolescent and early adult periods. Also, and in particular in the arts, it may be that the emotional maturity and drive necessary to creative production do not develop until late adolescence and early adulthood (with rare exceptions in the cases of artists like Pablo Picasso and Salvador Dali). Therefore,

although several investigations such as Cox's (1926) and Eidusons (1962) show most creative adults to have manifested considerable talents during childhood, there are probably many more equally talented who either fade out or achieve only quite mediocre adult careers.

FOOTNOTES CHAPTER 2

1. Gruber, H.E., "*Darwin on man : A psychological study of scientific creativity*." Dutton (ed). (New York, 1974).

CHAPTER 3
GENDER DIFFERENCES AND CREATIVITY

It may seem odd to cite sex differences in creativity as giving strong evidence of genetic factors, but it merits consideration.

In secondary schools and colleges in the Western World, far fewer girls than boys opt for science and mathematical courses (evidence of this is cited in Cole and Cole, 1971, and Maccoby and Jacklin , 1974). Few women obtain Ph. D's in science. Cole (1) quotes only 3% in the physical sciences in the 1970's; 8% in chemistry, 18% in biology, but 18% in sociology and 24% in psychology. He claims a considerable growth in their numbers during the 1970's, but it is difficult to disentangle this assertion when there are increasing numbers of women entering graduate work in all areas. Sometimes too, the total number of female science students increases, but the number of males increases even more, so that the female proportion actually drops. This discrepancy is greatest in high level employment, with extremely few women reaching full professorships in the natural sciences. The numbers of science publications by women also lag greatly behind those of men. Also women are more often employed as teachers than as research workers. What is more surprising is that the numbers of highly creative women in most of the arts are about as low as in the sciences. This is true in music and the visual arts, including sculpture and architecture. If we look through the Leaving Certificate History of Art course, how many women painters and sculptors/architects will we find? Possibly very few.

There can be no doubt that, in Western cultures, there are different pressures on boys or men, and girls or women to engage in different kinds

of interests, educational courses and careers. From about the age of one year, boys are given different toys than girls e.g. bricks or cars as opposed to dolls, cuddly animals or books. Boys are encouraged to engage in physical activities and are expected to be more aggressive. Girls are expected to be quieter, more conformist, and to express themselves more in verbal, rather than physical actions. The educational systems of Western society have accepted the same stereotyping, and often it is the influence of the teachers that deter girls from taking advanced mathematics and science courses and concentrating more in the arts, humanities, or domestic training. One researcher on the subject, Fox (2) wrote in 1980 that the proportions of mathematically or scientifically inclined girls vary considerably from one school to another, presumably because some schools have higher ability staff, or different traditions. Single sex schools for girls tend to produce more scientists than mixed sex schools, because their students are less affected by fear of competition with boys. Most girls in ordinary mixed schools show some degree of "fear of success", as they feel that superiority may make them less attractive and more intimidating to the opposite sex. (These findings may appear somewhat Dickenson in today's world where we strive so hard for sexual equality, but they are the results of much indepth research by many experts in the field of gender differences as recently as the mid 1980's).

There are, of course, large numbers of girls who reject these stereotypes and aim to become successful scientists or businesswomen, and raise a family but these *rebels* are in a considerable minority.

If one is to make a plausible argument for attributing sex differences in creativity, in part at least, to genetic factors, we cannot ignore the obvious biological differences between the two sexes. Males are endowed with very

obvious differences in physical musculature and hormones that produce greater strength and suitability for fighting. Therefore it is highly probable that males are by and large, more aggressive and dominant, and females more submissive and concerned with child nurture and domestic activities. Such differences are by no means restricted to Western culture, but, with few exceptions, apply throughout all human societies. Likewise, they occur in many animal/mammal species, where males do most of the hunting and fighting, and are less aggressive towards females than to males of their own species.

Family Talents and Strengths

The statement that creativity, or outstanding talent tends to "run" in families is frequently heard but is almost impossible to justify, because such resemblance between relatives can be attributed either to common genes, or to environmental influences,or to both, and we have no method to decide which is the most plausible argument.

According to Galton (1869) (3), just half of his historically eminent persons had parents or other close relations who were similarly gifted. As opposed to this, many instances of similar giftedness among siblings can be cited, where two or more have shown outstanding creative talent : for example the Bronte sisters, or particularly showing evidence of this phenomenon in artistic creativity were the Limbourg brothers, Paul, Herman and Jean, who came from a family with a very strong tradition of craftsmanship. Probably the most famous family example of this resemblance among siblings is that it the Bach family of musicians. From Veit Bach (died 1619) to Johan Christian Bach (died 1782) there is written evidence and information on some sixty related males spanning seven generations. Of

these, fifty three were well known as musicians, cantors, and/or organists, many of whom were eminent during their lifetimes.

Upbringing and Environment

The effects of home and school environment, and differences in upbringing appear to stimulate, or inhibit creativity in general, or to affect certain types of aspects of creative production. Again a number of studies on this subject have been carried out. One of the most informative was carried out by a research author "Roe" in 1952, on a group of scientists. Roe (4) claimed that in her group of scientists, every personality was unique. Yet she arrived at a rather frequent pattern of childhood growth. A great many of her subjects show a high degree of independence and "solitariness"; their relations with their parents were rather impersonal, though they were strongly encouraged in achievement and in intellectual interests. An unusual proportion of them were first born, or only children and many tended to show poor health which reduced their contacts with other children of their own age. Many also, had been strongly influenced by another relative, adult friend or an inspiring teacher. As adults they were rather detached and were much more strongly committed to their work than to social or sexual activities.

FOOTNOTES CHAPTER 3

1. Cole, J.R., *"Fair Science - Women in the scientific community."* (New York : Free Press, 1979).

2. Fox, L.H.; Brady, L.; Tobin, D. (eds), "*Women and the mathematical mystique*". (Baltimore : Johns Hopkins University Press).

3. Galton, F., "*Hereditary genius*." (London : Macmillan, 1869).

4. Roe, A., "*The making of a scientist*." (New York : Dodd, Mead, 1952).

CHAPTER 4

TEACHING CREATIVITY

> " .... The influence of genetic factors on the development of creativity is of minor, or no importance, it should be possible to teach or train many aspects of creative thinking in the same ways as educating to read and to do arithmetics .... (De Bono) (1)

Many writers believe that, from the earliest school years, the curriculum should include extensive training in a variety of divergent thinking tasks and that these should improve the all round capacity to show imaginative, flexible thinking leading up to creative problem solving. Other psychologists, such as Cattell and Butcher (1968) and MacKinnon (1968) are highly critical of such an approach. They point out that the work of creative scientists and artists is totally unlike Osborn's "Brainstorming" (2) or De Bono's lateral thinking (3), or the numerous schemes now being published for the enhancement of creative thinking.

MacKinnon (4), also points out that there is no evidence to support the theory that scientists and artists who received so called "creative training, as children, were in actual fact more creative than those who had not.

The Creative Process

Based upon the reports of eminently creative people, there is general agreement that the creative process consists of four successive stages. Wallas (5) (1926), drawing heavily upon the observations and findings of Helmholtz (1896), labelled them preparation, incubation, illumination and verification. Helmholtz (1896) noted that when confronted with a

problem, he as often as not worked intentively on it but came up with no solution. This is what he called the "preparation stage", where elements presumed to be relevant to the problem are learned or manipulated in an intellectual manner. When progress was not made, Helmlotz set the problem aside, this he called the "incubation stage". After some period of time, often with no clear cause, the solution simply came to his mind. This is the stage of "illumination" (sometimes called the stage of "inspiration"). As often as not, it was not the elements that he worked with during the preparation stage that were combined in the flash of illumination, but rather some element not before considered relevant that provided the key. After inspiration, the verification stage involved his subjecting the idea to scrutiny and putting it into its final form. The sequence of stages that has been outlined here, seems to be very general. Neither scientists nor artists get their creative ideas from purely logical intellectual work. After reviewing a large number of self-reports of creative people, Ghiselin (1952) concluded that

> "..... production by a process of purely conscious calculation seems never to occur." (6)

This is a very strong statement, but almost everyone who has written about the creative process has drawn a similar conclusion.

Poets and other writers are quite explicit about the effortless and nonintellectual nature of inspiration. Creative inspiration seems to occur in an altered state of consciousness. To back up this argument, we will examine statements and actual quotations from writers, poets, and mathematicians describing how they were filled, "quite suddenly and

without premonition" with creative inspiration. The poet Friedrich Nietsche describes the moment of inspiration thus ....

> "Everything occurs quite without volition, as if an eruption of freedom, independence, power and divinity. The spontaneity of the images and similarities is most remarkable." (7)

William Blakes comment about the composition of his poem on Milton is more extreme.

> "I have written this poem from immediate dictation, twelve or sometimes twenty or thirty lines at a time without premeditation, and even against my will ...." (8)

The English novelist William Thackeray described a similar type of "possession"

> "I have been surprised at the observations made by some of my characters. It seems as if an occult power was moving the pen. The character does or says something, and I ask how the Dickens did he come to think of that." (9)

It is interesting and somewhat surprising to note that scientists and mathematicians give very similar descriptions of their experiences, as this example from the French mathematician, Henri Poincare.

> "One evening, contrary to my custom, I drank black coffee and could not sleep. Ideas rose in crowds; I felt them collide until pairs interlocked, so to speak, making a stable combination. By the next morning I had established the existence of a class of Fuschian functions, those which come from the hypergeometric series; I had only to write out the results, which took but a few hours ..." (10)

Guilford's Views on Creativity

Guilford's presidential address to the A.P.A. in 1950, is generally viewed as the foundation of much contemporary research on creativity. He presented many opinions on the characteristics of creativity which have been compounded and supported by many leading contemporary psychologists. To list them briefly so that we begin to understand his thinking on the matter.

(1) *Creativity is a set of traits* : creativity is a "pattern of traits" that are characteristic of creative persons. Until recently, the trait theory has dominated the study of creativity.

(2) *Creativity should be stable* : by suggesting that creative potential might be discovered in childhood, Guilford indicated that underlying traits should show some long term stability.

(3) *Reliability of creative tests will be low* : considerable variations in actual creative productivity within people will lead to low reliability, which although Guilford did not specifically say, presents considerable measurement problems.

(4) *Completion tests are needed to measure creativity* : tests of creativity should, at least partly, be open ended, allowing responders to generate their own answers instead of identifying a correct one.

(5) *Creativity test scores will show little correlation with intelligence test scores* : abilities tapped by standard intelligence tests are relatively unimportant for creative behaviour, and those

underlying creativity are not tapped by intelligence tests. This presumed independence of creativity and intelligence anticipated the distinction between convergent and divergent thought in Guilford's structure of intellect and stimulated much research on creativity and creativity tests.

(6) *Creative performance depends on more than creativity* : motivational and temperamental traits determine whether an individual with creative ability actually performs creatively.

(7) *Creative abilities are continuously distributed* : whatever the nature of creative talent may be, those persons who are recognised as creative merely have more of what all of us have.

In his address to the A.P.A. (1950) Guilford stated that at least eight primary abilities underlay creativity. For most of these he suggested some possible tests, which will be included below with each.

(1) *Sensitivity to problems* : Creative people see problems where others do not, an ability possibly related to curiosity.

Test : List things that are wrong with, or could be improved in common household appliances.

(2) *Fluency* : Those people who produce large numbers of ideas are more likely to have significant ideas.

Test : State as many consequences as possible to a hypothetical situation such as "A new invention makes it unnecessary for people to eat."

(3) *Novel ideas* : Creative people have unusual but appropriate ideas.

Test : Note the frequency of remote verbal items in a word association test.

(4) *Flexibility* : Creative people should be easily able to change.

Test : Note the variety of types of answers to completion tests.

(5) & (6) *Synthesising and analysing abilities* : Creative thinking requires the organising of ideas into larger, more inclusive patterns and symbolic structures must often be broken down before new ones can be built.

(7) *Complexity* : Possibly related to synthesising, complexity refers to the numbers of interrelated ideas an individual can manipulate at once.

(8) *Evaluation* : At some point the value of new ideas must be determined.

Test : Rank in order of excellence, several correct solutions to a problem.

Guilford, then, saw creativity as a result of the action of several more or less independent traits. However, he, and most others came to focus on fluency, flexibility and to a lesser extent, novelty as the crucial aspects of creativity.

9. Thackeray, W.M., "*The works of W.M. Thackeray*". Vol. 12. (London : John Murray, 1899).

10. Poincaré, H., "*The foundations of science.*" (Lancaster P.A. : Science Press, 1913).

CHAPTER 5
THE RELATIONSHIP BETWEEN CREATIVITY AND INTELLIGENCE

The consideration of the relationship between creativity and intelligence has occupied the attention of many leading psychologists in the last few decades. Scientists working in a variety of other disciplines from genetics to engineering have also been intrigued by the contribution of intelligence to creative discovery and invention. And philosophers from Aristotle and Plato, to Immanuel Kant have pondered the origins of creativity and its relationship to rational and innovative thought. In this section of my dissertation, I will investigate the nature and extent of a relationship between creativity and intelligence and will propose and support a view that the two phenomena are related and integrate to produce an optimal mental performance (which in turn leads to the physical act of creativity e.g. writing a poem, piece of music, producing a painting, making a scientific/mathematical discovery).

A frequently recurring theme in the consideration of the dual phenomena of creativity and intelligence has been that creativity is not independent of the general factor of intelligence (Yamamoto, 1965). Intelligence appears to be a necessary, but not sufficient condition for creativity, that is, although intelligence appears to allow the development of creativity, it does not ensure that creative expression will always be forthcoming (Schubert, 1973). However, many, if not most students of the phenomena hold the view that intelligent thinking must also include some degree of creative thinking. The most prevalent view has been that creativity is a distinct category of mental functioning that has a limited overlap with

intelligence, both in the processes used and in the characteristics of individuals who exhibit them.

Because the terms creativity and intelligence convey such strong "images" to us, it is important that our examination not be hampered by conceptual "biases" stemming from images that may not be accurate. As De Bono (1971) suggests, we must

> "Break out of the old self-perpetuating patterns, and generate new ways of looking at things ...." (1)

So far, we are suggesting that creative production depends to some extent on general intelligence ability, and there is a certain amount of hard evidence to back up this statement. In their genetic studies of genius, Terman (1925) and Cox (1926) (2) clearly believed that adult genius was directly connected to high intelligence in childhood. They made estimates of the likely childhood I.Q's of three hundred eminent persons from history and found an overall average figure of approximately 135. But Cox provided good grounds for regarding this as an underestimation, attributable to the scarcity of information about many cases. She considered the correct figure to be nearer to 140-155. There were big variations, with some of her cases ranging up to 190 and a few as low as 100. When classified by type of achievement, philosophers were most able with average I.Q.'s of 147, writers 140, and scientists 135 were very high, artists were lower at 122, and soldiers were down at 115.

There are some more direct test results of living scientists. Gibson and Light (1967) gave the Wechsler Adult Intelligence Scale Test to 131 university scientists. Not many of these individuals, perhaps, were in the

genius class, but they would all have made many creative contributions to research in their own areas. The mean I.Q. was 126.5. Chemists and mathematicians were highest at 130, agricultural scientists lower at 121.7.

Terman's (1925) major contributions were based on very high I.Q. children (3) (from I.Q. 135 upwards) and he followed them through to adulthood. Although, most of them achieved successful educational and occupational careers, very few showed such outstanding abilities as to merit the term genius. A large amount of subsequent studies have confirmed that the exceptionally creative tend to show high intelligence scores and vice versa. But there are also many who are relatively high in one and low in the other.

Pre-Requisites for Creativity

When researching the whole question of creativity and intelligence, it is important to understand that there are certain conditions necessary for the production of creative thought/work. If creativity involves new combinations of mental elements, then it would certainly seem to be the case that the more mental elements a person had, the more creative he or she would be. Besides having a lot of mental elements, they should also be distributed across a wide area of subjects, if Poincaré is correct that "remote associations are most likely to give rise to creative ideas."

We may suppose that intelligence should be a good predictor of creativity, because the more intelligent one is, the more mental elements one should be able to acquire. MacKinnon (1962) states that there is a high correlation of intelligence with indices of creativity up to the average level (4). But when a certain threshold is reached (around I.Q. 120), further gains

in intelligence do not bring about much further rise in creativity. One doubts, however, that an I.Q. of 120 would be sufficient for creative work in all disciplines. Different areas of endeavour must certainly require different minimal levels of intelligence.

Area/Domain Relevant Skills

A necessary but not sufficient condition for creativity is that one should have certain skills or knowledge relevant to the area in which one is working. It is clear enough, for example, that one cannot think of a creative idea about physics if one does not know anything about physics. One cannot very well combine mental elements in a new way if the elements are not known to one in the first place. It is also clear that certain aptitudes or special abilities not directly connected with creativity are necessary. For example, to be a creative composer, one needs not only ability for creative thinking but also musical talent. Although there are certainly many notable exceptions, creativity is generally confined to a single area/domain. Michelangelo and Dante Gabriel Rosetti were both poets and visual artists, but they are the exception, rather than the rule.

The Creative Personality

Personality factors : It is probably quite correct to state that creative people have high levels of self confidence if we consider the most likely reaction to creative ideas. This reaction is, of course, often extremely negative (This has been proven time and again throughout the course of history). Without a good deal of self confidence, one would hardly be expected to venture toward a goal (production of a creative idea) that if reached, would most likely result in derision, hostility, and so on. Most people

simply do not like novelty. It must be the case that creative people do like it however, otherwise they would take no pleasure in producing creative ideas and indeed, would produce none. Except under rather unusual circumstances, people do not, of course, do things that bring them displeasure. The situation in which the person is in, has a direct effect on how motivational factors will determine the creative act. For example, if the person is in a situation where they will be punished for creativeness, then the motivation towards creativity will not be as strong, or will possibly be absent altogether.

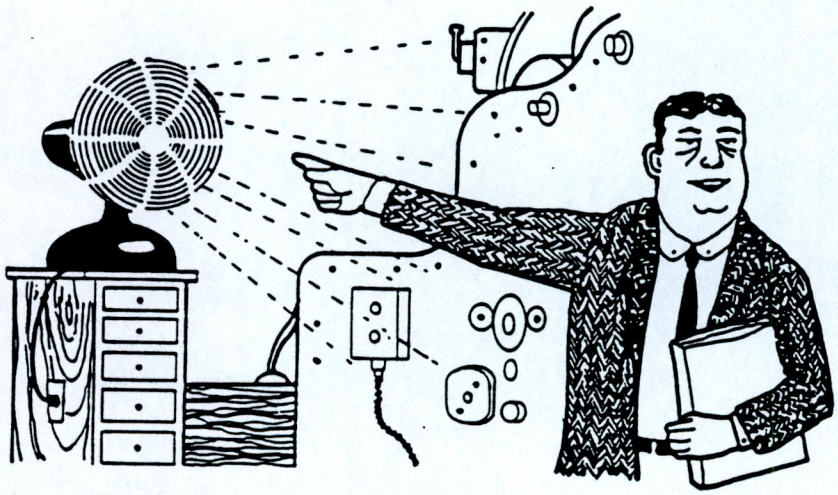
Creativity and Divergent Thinking

Before we discuss the relationship between creativity and divergent thinking, it is necessary to define what is meant by "divergent" thinking. Divergent thinking is characterised by thought processes that radiate outward and explore new ideas that are generated from the original notion. By its very nature, divergent thinking is exploratory and creative and leans towards the development of possibilities and speculations, rather than concrete facts and conclusions. In most contemporary literature, leading psychologists have aligned these two concepts into a sort of "you can't have one without the other" syndrome, and this has proven to be relatively accurate when we examine the writings of the experts in this field.

The main avenue of investigation and evaluation of divergent thinking comes in the form of numerous creativity tests formulated by various psychologists and authors who have studied this area. E.P. Torrance listed some relevant test tasks in the "Journal of Creative Behaviour" (1968) (5).

Creativity Tests

Problem One - List all of the questions you can think of concerning the figure shown below. Ask all of the questions you need to know for sure what is happening. Do not ask questions that can be answered just by looking at the drawing. (Time allowed 3 minutes).



Problem Two - Suppose that all humans were born with six fingers on each hand instead of five. List all the consequences or implications that you can think of. (Time allowed 3 minutes).

Problem Three - List as many white, edible things as you can in 3 minutes.

Problem Four - List all the words you can think of in response to "mother". (Time allowed 3 minutes).

Problem Five - List all the uses that you can think of for a brick. (Time allows 3 minutes).

Different Types of Thinking

Although a number of different methods for thinking have been developed over the years, they share one general idea. Creative problem solving is assumed to involve a series of stages, among which are consideration of the problem, generation of possible solutions, and evaluation of solutions. The main emphasis of most teaching methods is the stage of generating possible solutions, or, what would be called "idea finding". The basic assumption is that one increases the chances of creatively solving a problem by producing many ideas. Once an idea is generated, it can then be tried to see if it will work. According to this view, the difficulty is in the initial generation of ideas and that is where the teaching methods come in. Thus at least two types of thinking are assumed to be occurring here, one involved in producing ideas, the other involved in applying them to the problem and evaluating the outcomes. The first is "free form" associative thinking, while the evaluative thinking is standard, ordinary, logical thinking.

Edward De Bono's Lateral Thinking

Edward De Bono makes clear the distinction between these two types of thinking.

> "Everyone recognises the extreme usefulness of logical thinking, but many people are unaware that new ideas come about in a different way .... the logical way of using the mind is tremendously effective at developing ideas once they have come about, but it is not so good at generating the ideas .... (6)

De Bono is one of the many individuals who have developed methods designed to help the thinker produce novel ideas in response to a problem and thereby generate a fresh way of looking at it that results in a creative solution. These methods are designed to facilitate one's breaking away from old habits of thinking and allow one to produce ideas in response to a problem that one would ordinarily not produce. This, in turn is intended to present the thinker with new combinations of ideas or fresh ways of viewing the problem.

Other Divergent Thinking Tests

Carroll (1993) surveyed the results of a number of creativity/divergent thinking tests to investigate their relationship with the intelligence factor. The types of divergent tests surveyed by him are typified by the following list :

(1) Clever plot titles. The task is to write titles for story plots.

(2) Symbol production. The task is to produce (by drawing) figural symbols to represent given activities and objects.

(3) Remote consequences. The task is to list the consequences of certain hypothetical situations e.g. "What would be the consequences if people no longer needed or wanted to sleep?"

(4) Combining objects. The task is to name two objects which, when used together, would fulfil a particular need.

(5) Substitute uses. The task is to think of a common object used for an unusual purpose, e.g. a shirt used as a sail.

(6) Making groups. Given a list of seven words for objects or things, the subject has to specify up to seven ways of grouping or classifying the items.

He asked the question, what is the common element in such creativity tests? They require subjects fairly quickly to think of, and write down, a series of responses fitting the requirements of the task or situation that is presented. Furthermore, the task is such, that it is difficult and challenging for subjects to think of responses beyond the more obvious commonplace ones. This suggests a link with fluency; when a person gives a large number of responses, at least a few of these are likely to be more "creative" ones.

According to Carroll, scoring categories for tests of fluency, flexibility, and creativity fall into four categories.

(1) Fluency. Usually measured by the total number of responses.

(2) Flexibility. Measured in terms of the number of times a person changes spontaneously from one category of response to another.

(3) Originality. Scored according to whether responses are "unusual", "clever", or "original".

(4) Elaboration. Scored according to how elaborate response is, in terms of multiple detail given.

This enables us to differentiate between fluency and creativity. The "fluency factor" is a measure of the tendency of individuals to think of a large number of different responses, whether obvious or non-obvious, to any task lending itself to giving of numerous responses. On the other hand, the "creativity factor" is a measure of the tendency to give more unusual or creative responses when the task permits or requires such responses. Tasks measuring fluency generally do not permit to require unusual responses, whereas the tasks measuring creativity do.

FOOTNOTES CHAPTER 5

1. De Bono, E., "*New think.*" (New York, Avon Books, 1971).

2. Cox, C.M., "*The early mental traits of three hundred geniuses*". (Stanford C.A., Stanford University Press, 1926).

3. Terman, L.M., Genetic studies of genius : Vol. one. "*Mental and physical traits of a thousand gifted children.*" (Stanford C.A., Stanford University Press, 1925).

4. MacKinnon, D.W., The personality correlates of creativity : "*A study of American architects*". Proceedings of the XIV Congress of Applied Psychology (Vol. 2) (Copenhagen, 1962)

5. Adapted from Torrence, E.P., 'Examples and rationales of test tasks for assessing creative abilities' from the *Journal of Creative Behaviour.* (New York, Creative Education Foundation, 1968).

6. De Bono, E., "*Lateral thinking.*" (New York, Harper and Row, 1970).

CHAPTER 6
CREATIVITY AND INTELLIGENCE IN THE ART ROOM

In order to investigate whether or not intelligence affects or influences creativity in the art room situation, I decided to carry out some case studies on students from my first year class. (The first year class were chosen because there was recent and relevant information on their levels of general intelligence available from entrance exams taken by these students in May 1995). The entrance exams in my teaching practice school consist of two tests. One is the "Schonnell Reading Test" which gives a reading age in years and months and is known to be very accurate in its findings (this opinion was supplied by the career guidance teacher in the school). The second test is the A.H.2 (1) test, which is made up of three component parts which examine :

(1) verbal reasoning

(2) numerical reasoning, and

(3) perceptual reasoning.

I examined and recorded all the scores from these tests in order to classify the students according to their levels of general intelligence. To test whether or not these levels would have a positive correlation with their levels of creativity in the art room, I began to look for a creativity test which would give an indication of their imaginative ability and also include an aspect of drawing. The test I found to be the most suitable, was the "Circles Test". This was one of a number of tests surveyed by Carroll in 1993 to test creativity and divergent thinking. (This test has also been referred to and used by numerous other psychologists).

The test is an assessment of divergent thinking skills and the ability to represent those thoughts in a visual way. Students are given a page filled with empty circular shapes. They are then asked to convert each circle into an image or object which is largely circular in shape. They can add images to the outside or inside of the circle, and if their image is not self-explanatory, write what it represents beside the image. Also, two or more circles can be used in the representation of one image.

As I was introducing this concept to the students with the use of a few examples, I asked them to try to be original in their choice of images, and try not to use the most obvious objects and symbols. Also I decided to give the students a considerably longer time span to do the test than was suggested by Carroll. I gave approximately 15 minutes as opposed to Carroll's 5 minutes, because I wanted the students to complete the test satisfactorily and fill the thirty five circles on the page so that each student would be marked on the same number of attempts. I also designed my own marking scheme for the test, which gives a very high score to the images which were only used by one student, so that the divergent thinkers in the group would score highly on the test (See Appendix One). In a few cases, some of the students filled circles with different types of patterns, circles, dots, grids etc. ... I did not allocate any marks to these attempts as they were not representative of any object or symbol, they were merely filling up the circles in a mindless way.

A huge variety of images were achieved in this test, from the most obvious circular images like the sun, moon, clocks, eyes, flowers, glasses etc. to the much less obvious images of colanders, paw prints, weights, cooker tops, scissors, pencil sharpeners, and even a pig!!?? After the students had completed the test, I asked them what they thought of the

test, was it easy, hard, how would they classify it? Most students reacted the same way - they said that initially, when I explained the concept to them, they thought that this would be a very easy exercise. The first eight to ten images were easily achieved, but after that, things got more complicated. One student summed up this feeling very accurately when she said

> "The first bit was easy, but after that we really had to start thinking hard ..."

The students said that they were mentally exhausted from having to "think" so much during this test. Later on, when I was analysing the tests and calculating the scores, I recalled what they had said and found it amusing that an exercise in "original thinking" would be such an exhaustive process on the students. I will expand on this theory in my conclusion. I now had two sets of marks for each student, one which gave evidence of their general intelligence ability, and one which illustrated their creative/divergent thinking ability.

My findings showed conclusively that the students of high intellectual ability were also the most advanced divergent thinkers, capable of original thought processes. The students with the lowest marks on the AH2 tests also scored lowest on the creativity tests. These results prove that in my own personal investigations, there was a positive correlation between general intelligence test marks and creativity/divergent thinking test marks.

In the following pages, I will list the marks of four students from my first year class to illustrate my findings. I have taken the two highest and the

two lowest scores. In the case of each student, I will record their marks for general intelligence under the headings of :

(1) Reading Ability

(2) Verbal Reasoning

(3) Numerical Reasoning

(4) Perceptual Reasoning

The marks for creativity/divergent thinking ability have been taken directly from the "Circles" tests which can be seen on pages 45 - 48. The marking system has also been explained to show how the marks were attained.

Personal Assessment of Students Work in Terms of Creativity

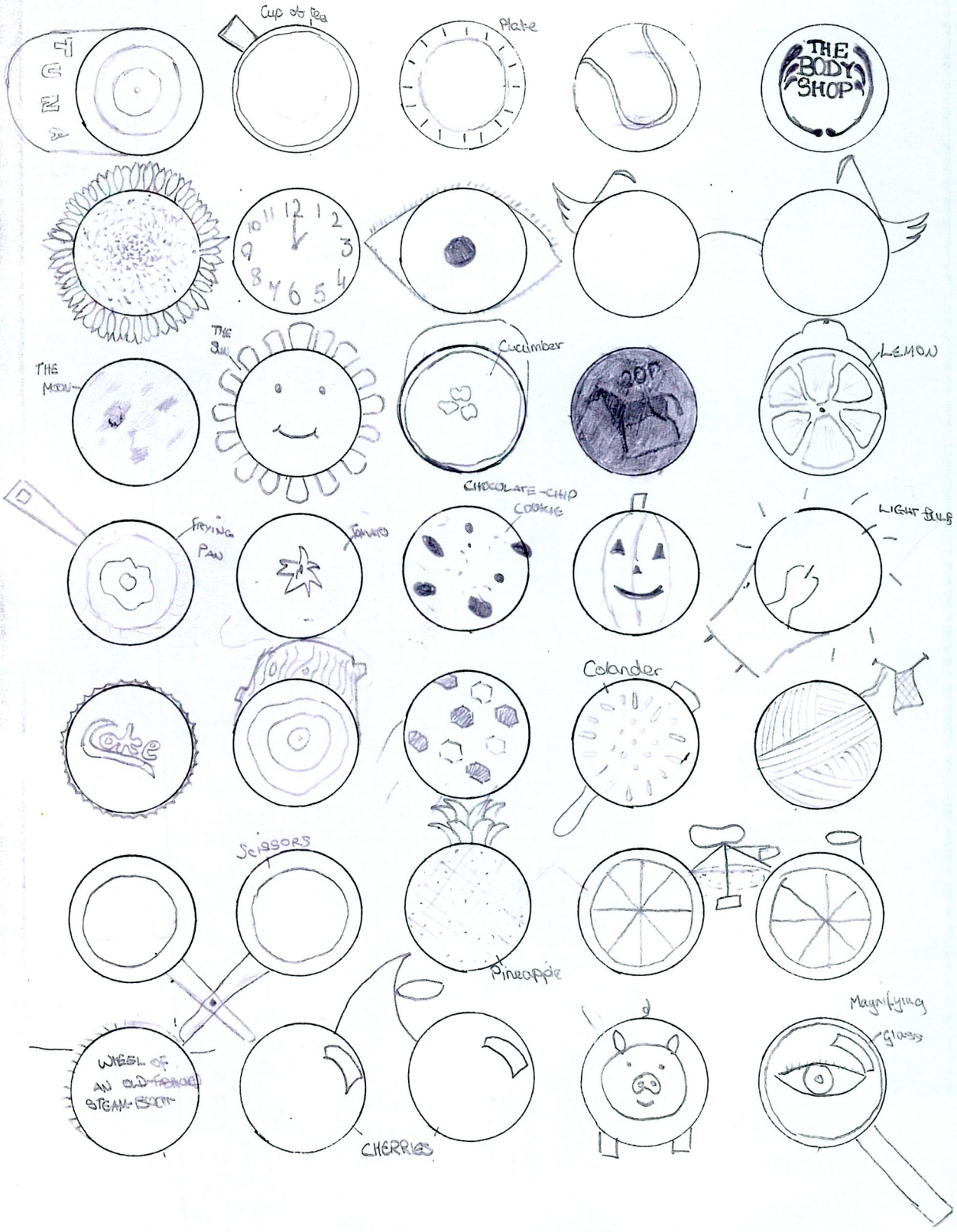
The students levels of intellectual and creative ability had now been assessed twice through formal testing methods which had a rigourous marking system. I wanted to assess their creativity in the art room with a practical project which would require imaginative and creative work in the areas of design, construction and decoration, bringing an idea from the initial conception to the finished product. I chose to introduce a 3-D project, which would initiate the students to the ideas of unit construction (using boxes of all shapes and sizes collected over a period of time). The theme was "Space age/futuristic buildings", which I thought would inspire some very unusual, imaginative and creative shapes and constructions. The boxes used by the students were all "ready made" boxes, but the challenge was to put them together and decorate them in a visually creative way. The buildings illustrated on pages 51 - 54 are the ones created by the four students that I have studied previously. I assessed the finished pieces in terms of their divergence from "normal" buildings,

their "unusualness" and their resemblance or non-resemblance to box shapes.

The buildings designed by Linda and Danielle, the high achievers on the AH2 and circles tests, were in my opinion, definitely more successful in terms of creativity and originality, as I felt that they had achieved a far more "futuristic" look and looked less like a group of boxes stuck together. Joanna and Niamh, who scored lowest on the above mentioned tests produced buildings that were very "boxy" looking, and did not show much evidence of original thought. These opinions are purely personal, but have been encouraged and agreed with by the two art teachers in my school who have also evaluated and assessed the work at my request.

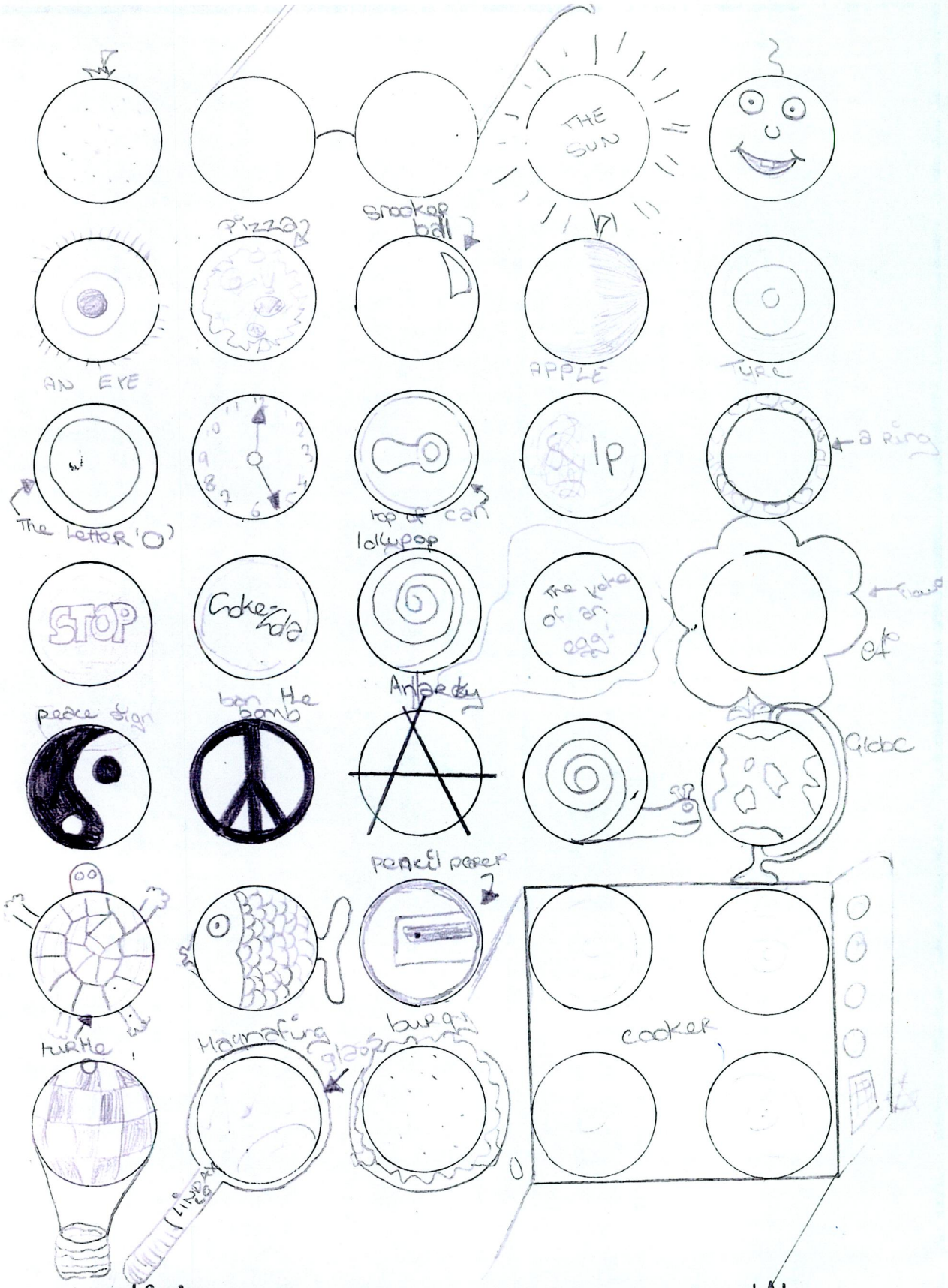
FOOTNOTES CHAPTER 6

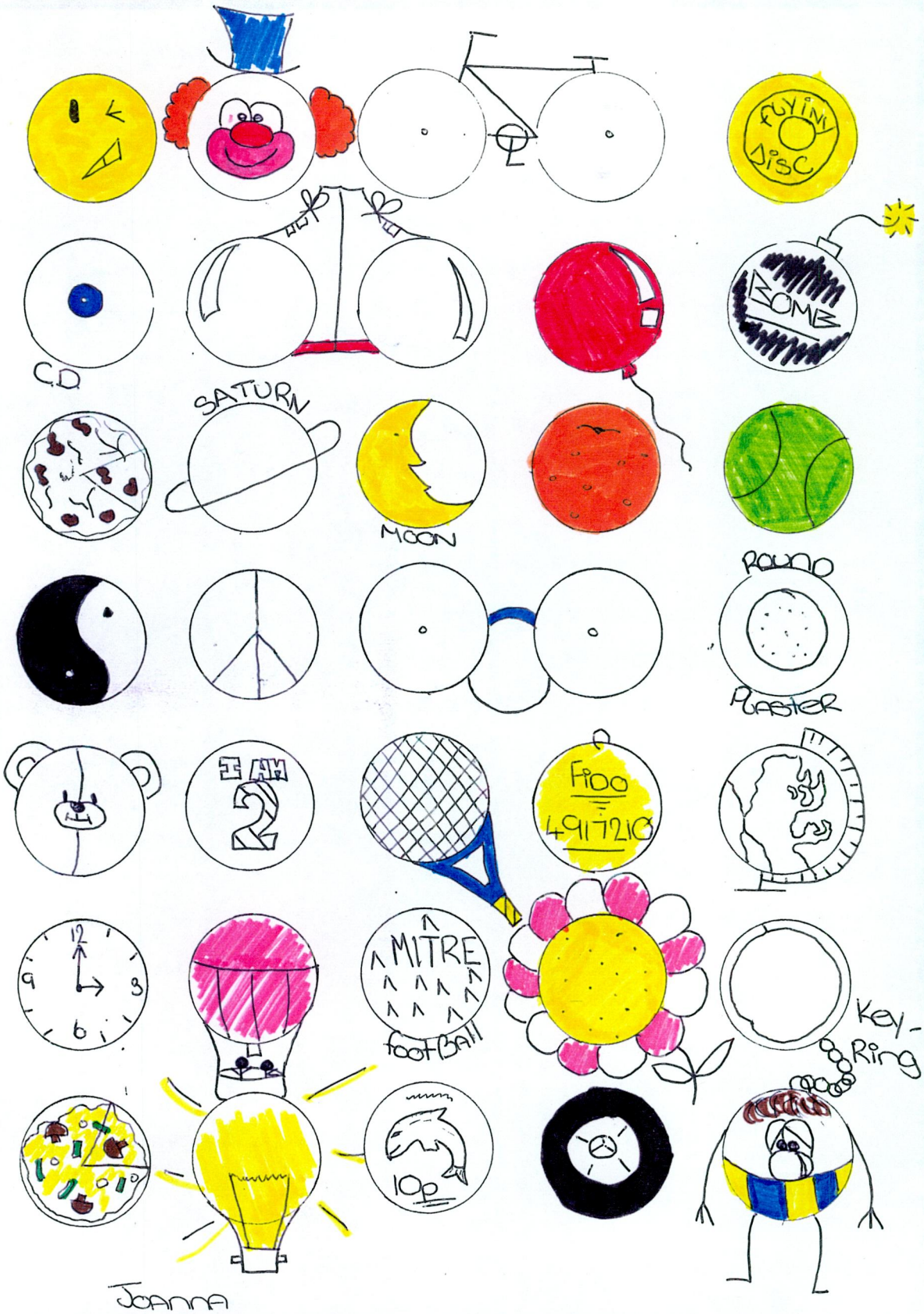
1. The A.H.2 test was created by Alice Heams in conjunction with Cambridge University Press. It is a general intelligence test which assesses three areas of student ability :
   (1) verbal reasoning
   (2) numerical reasoning
   (3) perceptual reasoning.
   It is widely used as an entrance test in secondary schools in Ireland and is generally regarded as a more accurate assessment of student ability than the "Drumcondra" test, which only assesses verbal reasoning.



NAME Daniela

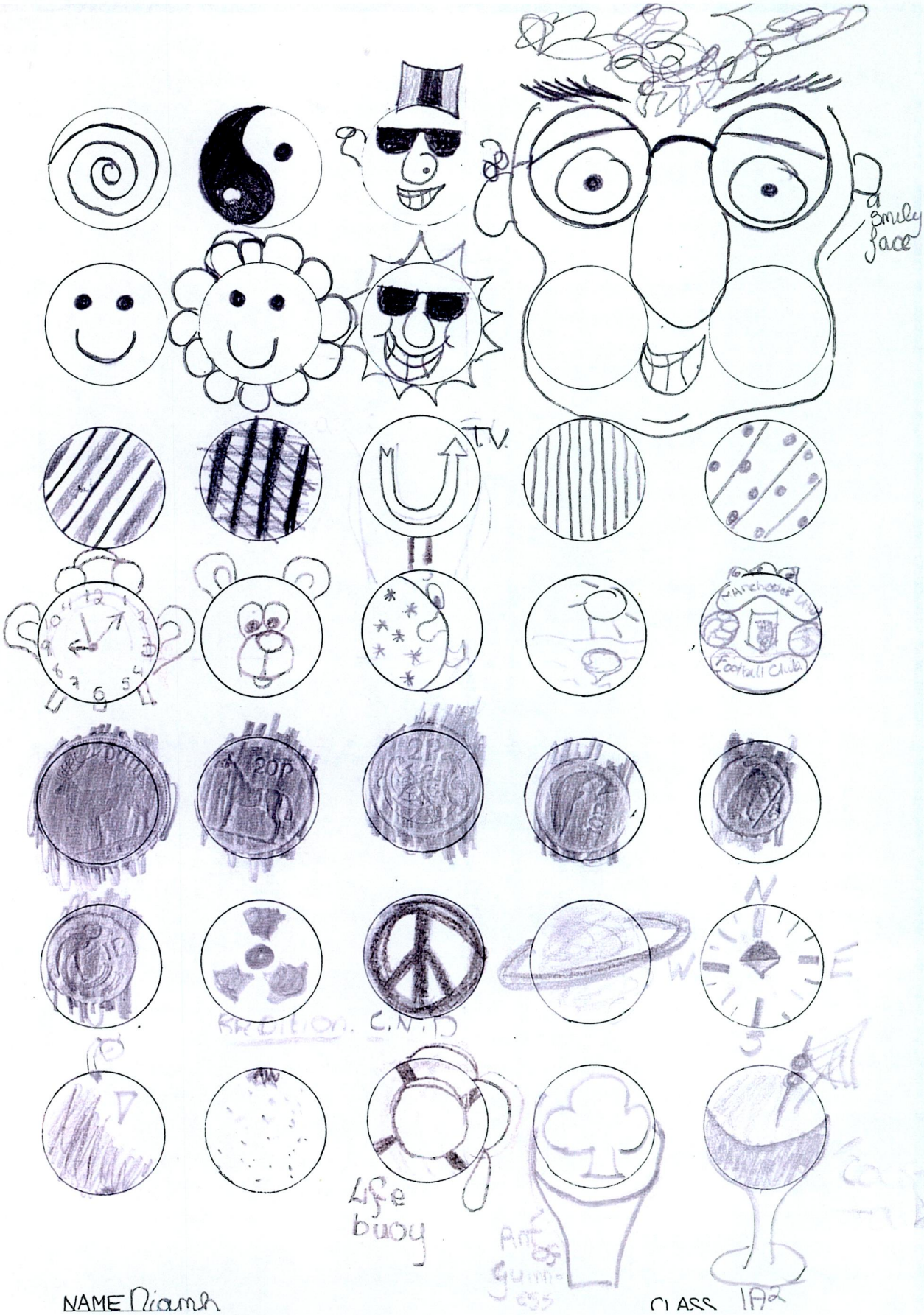
CLASS 1A1


THE SUN
Pizza
snookap ball
AN EYE
APPLE
TURE
a ring
The Letter 'O'
top of can
lollypop
lp
STOP
Coke-Cola
The yolka of an egg!
Anarchy
peace sign
ban the bomb
Globe
pencil paper
turtle
Harnessing
cooker
NAME Linda
CLASS 1A



JOANNA

NAME _____ CLASS 1A'



NAME Niamh

CLASS 1A2

Student One - DANIELLE

Danielle scored 41 on the Schonell Reading Test. Her actual age at the time of the test was 12 years 11 months. Her reading age was 14 years and 1 month.

On the AHMZ Test she scored thus :

Verbal reasoning	33 marks	grade A
Numerical reasoning	27 marks	grade A
Perceptual reasoning	34 marks	grade A

Total marks	94 marks	GRADE A

On the circles test Danielle scored 309 marks, the highest in the class. Eighteen of her thirty five drawings were exclusive to her showing great originality of thought (Appendix 2).

Student Two - LINDA

Linda scored 36 on the Schonell Reading Test. Her actual age at the time of the test was 12 years, 4 months. Her reading age was 13 years and 8 months. On the AHMZ Test she scored as follows :

Verbal reasoning	25 marks	grade B
Numerical reasoning	26 marks	grade A
Perceptual reasoning	31 marks	grade A

Total marks	82 marks	GRADE A

On the circles test Linda scored 214 marks, the second highest in the class. Eight of her illustrations were exclusive to her also showing great originality (Appendix 3).

Student Three - JOANNA

Joanna scored 25 on the Schonell Reading Test. Her actual age at the time of the test was 13 years, 1 month. Her reading age was 10 years and 7 months. On the AHMZ Test she scored as follows :

Verbal reasoning	14 marks	grade D
Numerical reasoning	14 marks	grade D
Perceptual reasoning	17 marks	grade C

Total marks	45 marks	GRADE C

On the circles test Joanna scored 148 marks, definitely at the lower end of the marks. Four subjects from the test were exclusive to her (Appendix 4).

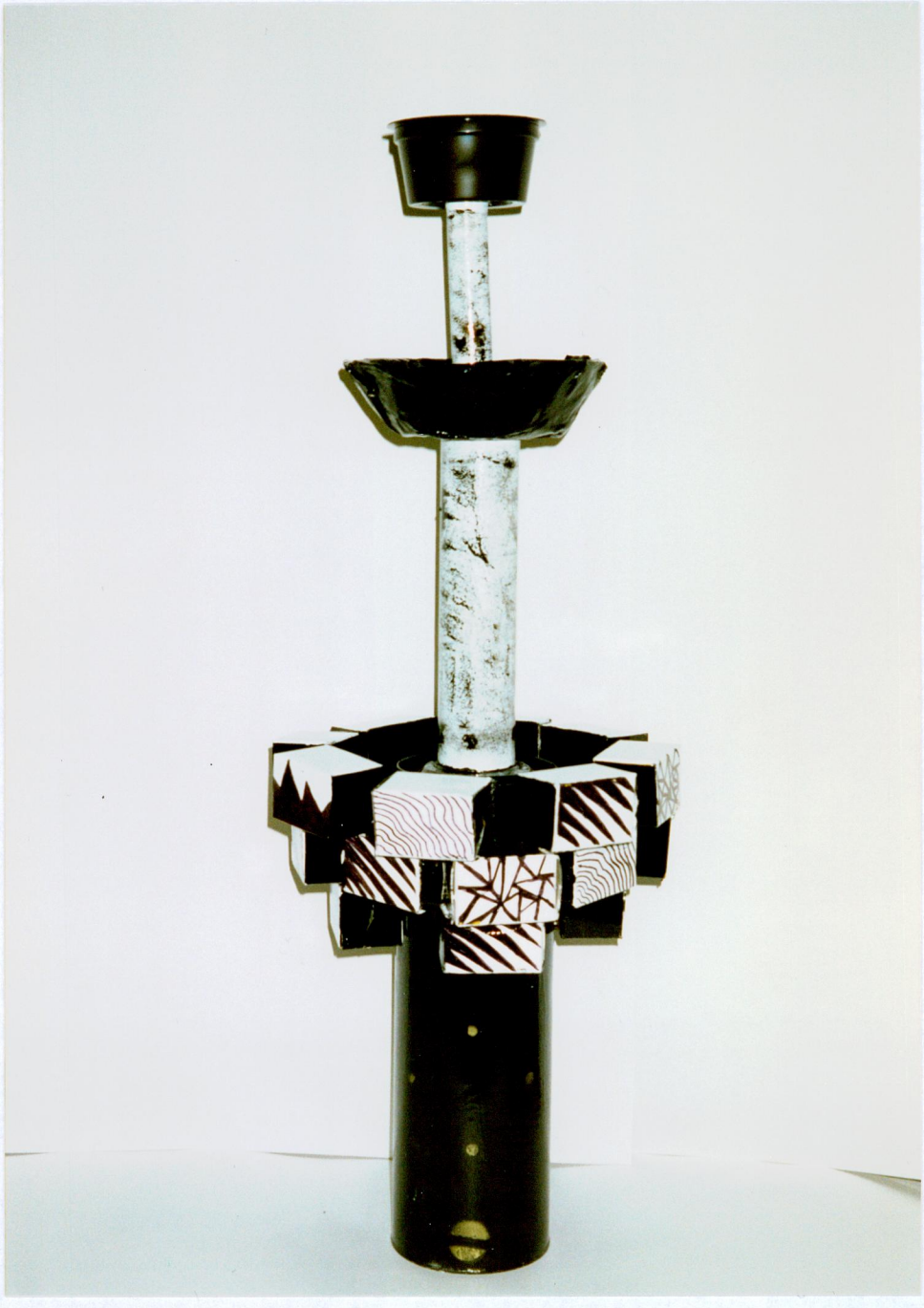
Student Four - NIAMH

Niamh scored 23 on the Schonell Reading Test. Her actual age at the time of the test was 12 years, 2 months. Her reading age was 10 years and 3 months. On the AHMZ Test she scored as follows :

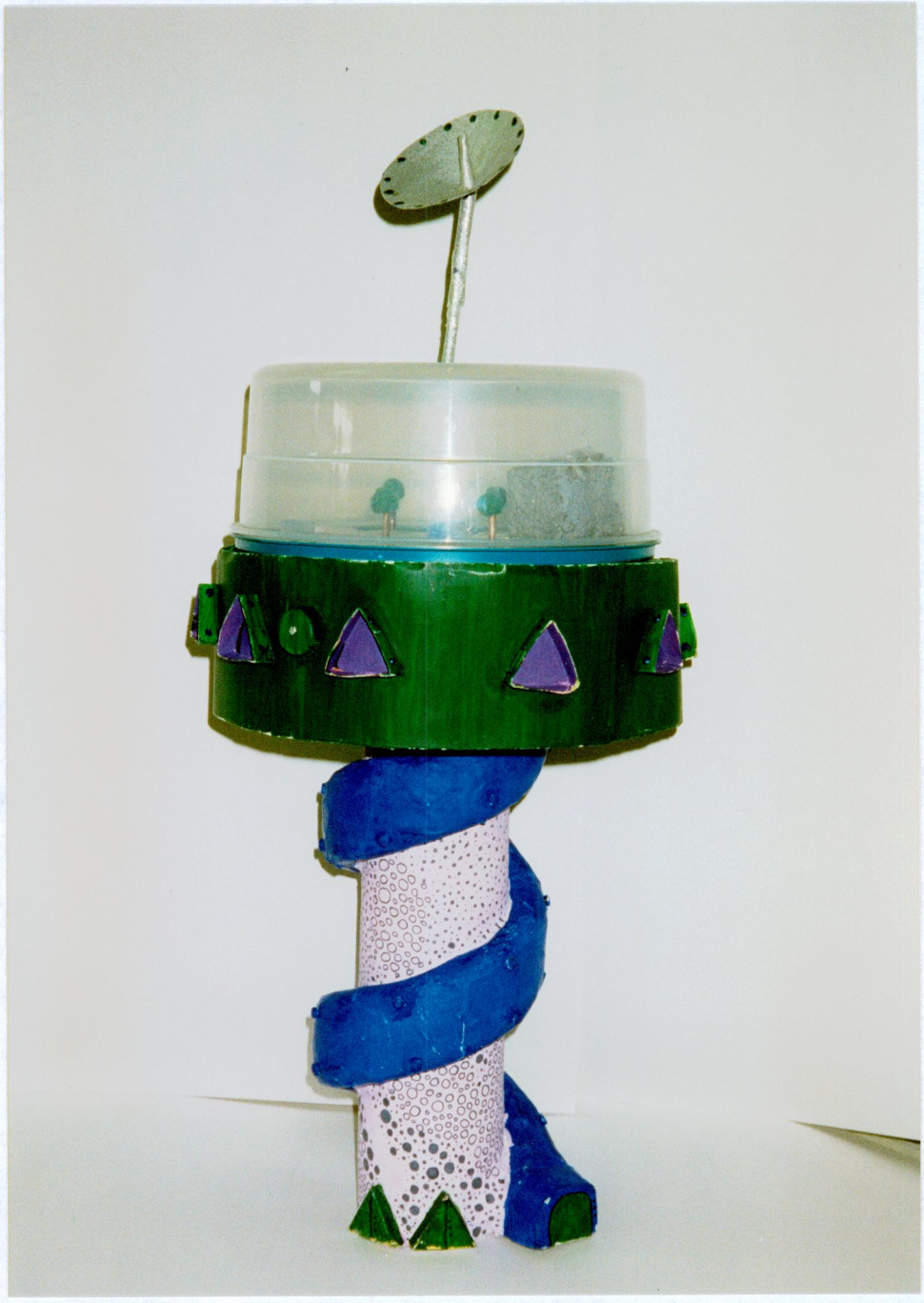
Verbal reasoning	16 marks	grade C
Numerical reasoning	16 marks	grade C
Perceptual reasoning	13 marks	grade D

Total marks	45 marks	GRADE C

On the circles test Niamh scored only 93 marks, the lowest in the class. One object in her test was exclusive to her (Appendix 5).



Space age building constructed by Danielle.



Linda's building.

Joanna's building.

Niamh's building.

CONCLUSION

After spending some considerable time studying the vast amount of literature available on the subject of creativity, it would seem quite accurate to say that there are many variables and situations that affect and influence the development of creative powers. These range from social and environmental factors to gender and cultural differences.

On the subject of the nature/nurture debate in creativity, evidence favouring both sides of the argument has surfaced, in the form of actual quotations and statements from the people concerned, to documented scientific evidence from highly respected researchers. It has been proven that genetic factors are not an absolute pre-requisite for creativity. It is widely felt that while many creative and intelligent personalities have surfaced with no history or background of creativity (in the form of talented parents, ancestors etc) it is nevertheless certainly not a disadvantage to any child, to be born of parents who have certain gifts or talents.

In a society where equality is an issue that is being constantly debated, it has been very interesting and quite surprising to study the documented evidence from the most recent reports on gender differences in the highest echelons of creative thought and research. It is a fact that the majority of society's "creative" people are male. It has already been discussed earlier in this dissertation (in Chapter Three), the possible reasons for this, but what can we, as teachers do to provide a more balanced gender ratio? The answer to this problem lies with each individual teacher. It is the teacher's responsibility to promote and encourage creativity in all their students,

regardless of gender. The 21st century will very probably see an evening out of the gender imbalance in all fields.

On the question of the relationship between creativity and intelligence, I have found, in my own personal case studies that there is a positive correlation between the two. In the case of the four students that were assessed, the results very definitely concurred with this theory. However, it would be foolish and naive to suggest that these results represent a definite swing in that direction, they are the results of one small personal study. But at this point, I must state for the record, that in my own personal experience of teaching, I have found it to be true in the majority of cases that the creative and artistic students are usually also quite intelligent.

Teachers must exercise their professional judgement to assess creativity in the art room, and of equal importance, they must encourage and promote creative thought and work. It is a widely accepted and well proven fact that most secondary schools in this country do not promote creative thinking. They encourage convergent thinking and admire and reward students who stay on the "beaten track" and do not diverge from the "tried and trusted" methods of doing things. Many teachers are hostile towards divergent personalities in the classroom, they see them as troublemakers, and discourage their questioning and thought processes. We must therefore ask ourselves the question : Are our schools and centres of education primarily driven to produce students who swallow and regurgitate information but never learn how to get the nutritional value and energy from it and put it to good use? Do we promote a system that does not encourage individual and creative "thought"? Is it a negative statement on our system that the first year students referred to earlier in

the chapter were mentally exhausted after completing a short exercise which required some creative/divergent thought? The answer to most of these questions is yes, which does not paint a pleasant picture of the present secondary school system in this country. The attitude and environment in a lot of schools is authoritarian and students are under pressure to conform. There is an overemphasis on success (exam success), and intolerance of playful attitudes and unfortunately, many teachers with extremely rigid personalities. All of these factors serve to inhibit and stifle creative thought and work.

In order to encourage and promote creativity in the classroom, teachers need to : -

1. Value creative thinking.
2. Make children more sensitive to environmental stimuli.
3. Encourage the manipulation of objects and ideas.
4. Develop a tolerance of new ideas.
5. Beware of forcing a set pattern.
6. Develop a creative classroom atmosphere.
7. Teach children to value their creative thinking.
8. Encourage self-initiated learning.
9. Develop constructive criticism - not just criticism.
10. Provide for active and quiet periods.
11. Encourage the acquisition of knowledge in a variety of fields.
12. Encourage the habit of working out the full implications of ideas.

I feel that the art room is one of the few locations in schools where these values and principles are being encouraged, particularly since the introduction of the new Junior Certificate Art, Craft and Design exam,

which promotes and encourages students to develop themes which hold some personal interest to them and therefore become self-motivating.

The last question to be addressed is one which remains largely unanswered and it is : what is creativity and how do we define it? Numerous writers and researchers have been unable to agree on these questions. Perhaps the answer is that one's interpretation of creativity is purely personal.

APPENDIX 1

MARKING SCHEME FOR CIRCLES TEST

This test was designed to reward the divergent thinker. Any objects that were illustrated numerous times by the group were allocated a low score. The objects that were illustrated only once (and were therefore exclusive to that student) received a very high score and so on. Below are the marks allocated.

Objects Illustrated	1	Time(s) Receive	15	Marks
	2		10	
	3		6	
	4		5	
	5		4	
	6		3	
	7		2	
	8		2	
	9		2	
	10		1	
	11		1	
	12		1	
	13		1	
	14		1	
	19		1	

APPENDIX 2

DANIELLE	*	Marks
Tin of fish	1	15
Cup of tea	1	15
Plate	1	15
Tennis ball	19	1
Body Shop logo	1	15
Flower	10	1
Clock	10	1
Eye	10	1
Glasses	10	1
Moon	6	3
Sun	10	1
Cucumber	1	15
Coin	9	1
Lemon	1	15
Frying pan	1	15
Tomato	1	15
Biscuit	1	15
Pumpkin	1	15
Light bulb	2	10
Coke bottle top	1	15
Cross section of tree	1	15
Ball	19	1
Colander	1	15
Ball of wool	1	15
Scissors	1	15
Pineapple	1	15
Bicycle	3	6
Wheel	7	2
Cherries	1	15
Pig	1	15
Magnifying glass	2	10
TOTAL MARKS		**309**
18 objects were exclusive to Danielle		
* *shows how many times each object came up in all the tests.*		

APPENDIX 3

LINDA	*	Marks
Orange	6	3
Glasses	10	1
Sun	10	1
Balloon	7	2
Eye	10	1
Pizza	4	5
Snooker ball	19	1
Apple	6	3
Tyre	2	10
Letter O	1	1
Clock	1	1
Top of mineral can	7	2
Coin	1	1
Ring	2	10
Stop sign	2	10
Coke logo	1	15
Lollypop	6	3
Fried egg	1	15
Flower	10	1
Peace sign	8	2
And sign	6	3
Anarchy sign	1	15
Snail	2	10
Globe	6	3
Turtle	1	15
Fish	1	15
Pencil sharpener	1	15
Hot air balloon	2	10
Magnifying glass	2	10
Burger	1	15
Cooker top	1	15
TOTAL MARKS		**214**
8 objects were exclusive to Danielle		
* *shows how many times each object came up in all the tests.*		

APPENDIX 4

JOANNA	*	Marks
Face	14	1
Face	14	1
Bicycle	3	6
Frisbee	1	15
C.D.	2	10
Books	1	15
Balloon	7	2
Bomb	3	6
Pizza	4	5
Planet	7	2
Moon	6	3
Orange	6	3
Ball	19	1
Peace sign	8	2
CND logo	6	3
Glasses	10	1
Plaster	1	15
Face	14	1
Badge	1	15
Racket	6	3
Identity tag	1	15
Globe	6	3
Clock	10	1
Hot air balloon	2	10
Football	19	1
Flower	10	1
Key ring	5	4
Pizza	4	5
Lightbulb	2	10
Coin	9	1
Wheel	7	2
TOTAL MARKS		**148**
4 objects were exclusive to Danielle		
* *shows how many times each object came up in all the tests.*		

APPENDIX 5

NIAMH	*	Marks
Pattern	/	/
Face	14	1
Face	14	1
Face	14	1
Flower	10	1
Sun	10	1
Pattern	/	/
Pattern	/	/
Pattern	/	/
Pattern	/	/
Road sign	4	5
Clock	10	1
Face	14	1
Moon	6	3
Sun	10	1
Logo	6	3
Coin	9	1
Coin	9	1
Coin	9	1
Coin	9	1
Coin	9	1
Coin	9	1
Radiation sign	1	15
CND sign	6	3
Planet	7	2
Compass	2	10
Apple	6	3
Orange	6	3
Lifebuoy	2	10
Pint of Guinness	2	10
Cocktail	2	10
Peace sign	8	2
TOTAL MARKS		**93**
1 objects were exclusive to Danielle		
* *shows how many times each object came up in all the tests.*		

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