The correlation between intelligence quotients, refractive error and other ocular factors.

Subhanshi Singh,Susmita Banerjee

ABSTRACT

Purpose: To evaluate the correlation between intelligence and myopia in children. The relationship between refractory errors and intelligence and the importance of axial length, corneal curvature and read book per week factors in such associations, were investigated in a group of emmetropic and myopic children.

Methods: Fifty eight children (28 myopic and 30 emmetropic) were enrolled in the study. Cycloplegic refraction was performed in spherical equivalent (SE) <-0.5D were determined myopia . and ocular biometry parameters, including axial length, corneal curvature anterior chamber depth , corneal curvature thickness were obtained in children aged 05 to 12 years along with Intelligence questionnaire.(IQ- questionnaire). Demographic factors read books per week were also evaluated.

Results: Myopic children are more intelligent then the normal (emmetropic) children ,The correlation between Intelligence quotients (IQ) ,refractive error and other ocular component are significance .

Conclusion: The conducted clinical observations suggest that children with myopia may have a higher IQ. This relationship is most probably determined by genetic and environmental factors such as reading , IQ may be an independent risk factor of myopia, and this relationship may not be explained merely by increased reading (books per week) among myopes. An interesting observation is that nonverbal IQ may be a stronger risk factor for myopia compared with books read

per week. The complexity of the relationships between nonverbal IQ, reading, and myopia warrant additional studies to clarify any cause–effect relationship. (Invest Ophthalmol Vis Sci. 2004; 45:2943–2948) DOI:10.1167/iovs.03-1296

INTRODUCTION

In this literature we are trying to explain the correlation between Intelligence Quotient(IQ) , Refractive error and other ocular factor such as Axial length , Corneal curvature ,Corneal curvature thikness(CCT) , Anterior chamber depth (ACD) .

INTELLIGENCE QUOTIENT(IQ)- Intelligence involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience. Rather it reflects a broader and deeper capability for comprehending our surroundings.

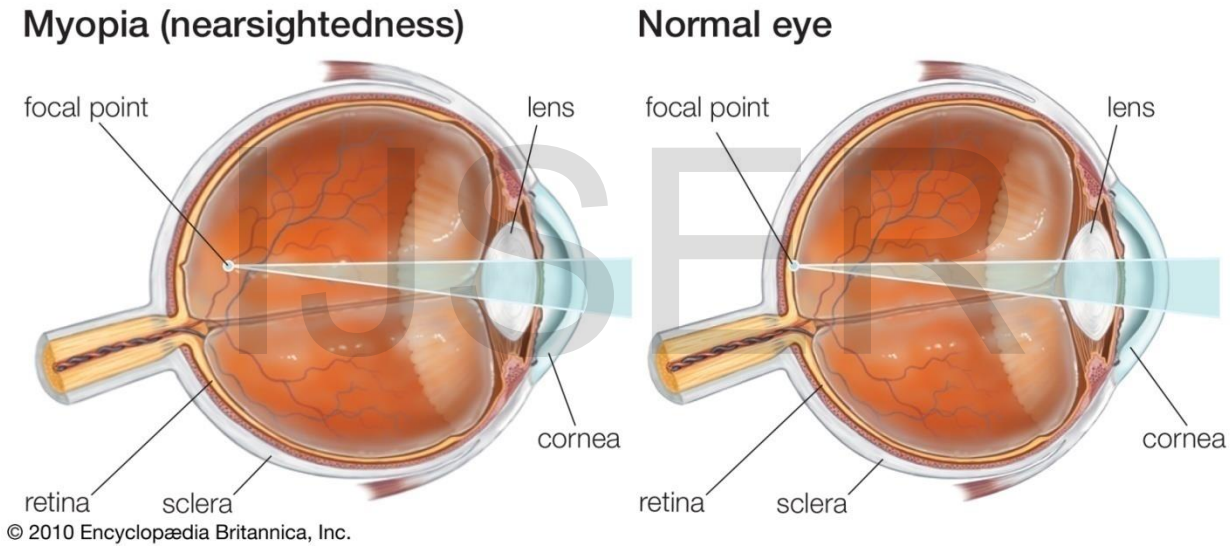
Most definitions of intelligence focus on the capacities that are important for success in school. While problem-solving is recognized as a crucial component of intelligence, but the ability to fashion a product to write a symphony, execute a painting, stage a play, buildup and manage an organization, and carry out an experiment is not included, presumably because the aforementioned capacities cannot be probed adequately in short-answer tests. These days literature has brought up newer theories on intelligence, which encompass more features than just linguistic or logical-mathematical abilities.

An approximate IQ score was calculated using the score on the Ravens test. IQ scores were divided into three groups: below normal IQ (0–79), normal IQ (80–119), and high IQ (above 120).

PATHOGENESIS OF MYOPIA – Myopia is classified as axial myopia(when the axial length of the eye ball is increased) and refractive myopia (when the optic centers of the eye refract light too strongly). Based on clinical aspect myopia can be classified as high myopia (< -6D) as well as low myopia (_> - 6D) . High myopia is genetically determined. Low myopia is mostly determined by environmental factors. especially by intensive visual near-work-reading ,writing ,working on a computer.

That is the reason why ,it is currently believed that visual near-work may lead to the creation of myopia , while visual far-work may lead to the creation of hyperopia.

Presently, the most often encountered form of myopia is school myopia, related to slight chronic under accommodation. It occurs before and during pubescence. In the process of school myopia, nearing of the far and near vision point occurs, a range of good vision is limited, uncorrected visual acuity decreases, accommodation failure appears, leading to accommodation spasm as well as an increase of convergential tonus during near work, and disequilibrium between accommodation and convergence



AXIAL LENGTH - The average newborn's eyeball is about 16 millimeters in diameter, from front to back (axial length). In an infant, the eye grows slightly to a length of approximately 19½ millimeters. The eye continues to grow, gradually, to the length of about 24-25 millimeters .

The Axial Length (AL) is the distance from the corneal surface to an interference peak corresponding to the retinal pigment epithelium/Bruch's membranee . A majority of axial length elongation takes place in the first 3 to 6 months of life and a gradual reduction of growth over the next two years, and by three years the adult size is attained. It is found that the depth and volume of the anterior chamber diminish with age and are related to the degree of ametropia.

axial length tends to grow upto16-18 years of age. Then after it ceases to enlarge. Also it was observed that myopes tend to have longer axial length and hypermetropes tend to have a shorter axial length comparing to that with emmetropes and astigmatics upto certain age group.

CORNEAL CUVATURE - Corneal diameter The corneal diameter (CD) is the limbus-to-limbus distance and clinically both the horizontal and vertical dimensions are regarded as important. The horizontal corneal diameter (horizontal visible iris diameter, HVID) is the distance between the nasal and temporal imaginary limbal tangents to the corneal circumference, HVID includes the centre of the pupil, as does the vertical visible iris diameter, VVID

The horizontal diameter of the cornea on average is 10 mm in infants and 11 mm in adults while the vertical diameter is usually 11 mm in infants and 12 mm in adults11.

The corneal curvature is much steeper in infants than in adults.

Anterior corneal curvature - The anterior corneal curvature (ACC) relates to the shape of the front surface of the cornea and is one of the important measurements used to characterize optical properties of the cornea
In clinical practice, both horizontal and vertical anterior corneal curvatures are usually measured. The average cornea has a smaller radius in the vertical meridian compared to the horizontal meridian, which contributes to higher incidence of with-the-rule astigmatism in young adults1 . Anterior curvature expressed in radii (typically millimeters) is important for contact lens fitting and management8 , ocular aberration analysis, corneal refractive surgery as well as diagnoses and management of corneal pathological conditions such as keratoconus22. Measurement of ACC can be made with a variety of instruments, such as a keratometer, IOLMaster, or corneal topographer5, 6. Although the keratometer provides a reliable and accurate assessment of the ACC, the instrument measures the corneal curvature based on an approximate central area of 3.2 mm of its surface. Also, the calculation of corneal radius assumes the cornea to be a sphere with a refractive index of 1.3375, which is not true1, 4. According to Veys et al8 , the variations in curvature across the surface of the cornea can be quantified by calculating the shape factor at different points across its surface. The shape factor can be described in terms of eccentricity (e), where shape factor (p) = 1 – e2 . The shape factor varies between 0 and 1, where 1 is a perfect sphere. Techniques such

as keratoscopy provide a measurement of shape factor, so the change in contour across the whole cornea can be assessed more comprehensively

7.75 -7.65 is range of ACC in normal populations.

CENTRAL CORNEAL THICKNESS- Central corneal thickness (CCT) and its measurement are important in many eye care procedures, such as tonometry and refractive surgery. The detection and management of contact lens related complications and certain surgical procedures (such as astigmatic keratectomy, LASIK, PRK and Intacs placement) rely on the accurate measurement of CCT Corneal pachymetry is the process of measuring the thickness of the cornea and can be done using contact methods such as ultrasound and confocal microscopy or non-contact methods such as optical biometry with a single Scheimpflug camera (such as the Oculus Pentacam or Sirius), Dual Scheimpflug (for example, Galilei), coherence tomography (Visante, iVue or others), optical coherence pachymetry (with Orbscan)

Average normal values for the human CCT is - 512.4±38.9 526.5±37.2.

ANTERIOR CHAMBER DEPTH(ACD) - The anterior chamber depth is influenced by the growth of the sclera, as well as by factors related to lens movement and thickness. There are many methods to evaluate the anterior chamber including slit-lamp photography, ultrasound biomicroscopy, and anterior segment optical coherence tomography . Using some of these methods, estimates of the anterior chamber depth average 2.05 mm with a range of 1.8 to 2.4 mm in depth . The depth continues to increase until the end of adolescence, and then it progressively diminishes.

In emmetropic patients, the increase in anterior chamber depth appears to stop at an earlier age, compared to patients with myopia . This apparent difference is related to the continued changes in the lens and axial length in patients with myopia. The anterior chamber depth appears to vary with ethnicity as well .

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. IQ AND THE ASSOCIATION WITH MYOPIA IN CHILDREN

Seang-Mei Saw; Say-Beng Tan; Daniel Fung; Kee-Seng Chia; David Koh; Donald T. H. Tan; Richard A. Stone

To evaluate the association between intelligence and myopia in children. All children from grades 1 to 3 from three "normal" schools located in the Southeastern, Western, and Northern parts of Singapore were invited to join the Singapore Cohort Study Of the Risk Factors for Myopia (SCORM) in 1999 and 2001. The children who participated in SCORM completed a nonverbal IQ test administered by our study staff and a psychologist on the school's premises in 2002, using the Raven Standard Progressive Matrices.

The relationships between axial length and refraction with nonverbal IQ, after controlling for age, gender, school, parental myopia, father's education, and books read per week are shown in. Similar to our findings of myopia as a dichotomous variable, nonverbal IQ was significantly associated with refraction, before and after controlling for books read per week. The multivariate adjusted mean refractive error for children with nonverbal IQ in the highest quartile was −1.86 D compared with −1.24 D for children with IQ in the lowest quartile ($P = 0.002$). For every point increase in nonverbal IQ score, there is a 0.042 D shift in refraction toward more myopic values ($P < 0.001$). For every point of increase in nonverbal IQ score, the axial length increased by 0.018 mm and vitreous chamber depth by 0.017 mm (both P's < 0.001). An interesting observation is that nonverbal IQ may be a stronger risk factor for myopia compared with books read per week. The complexity of the relationships between nonverbal IQ, reading, and myopia warrant additional studies to clarify any cause–effect relationship.

2. ARE CHILDREN WITH MYOPIA MORE INTELLIGENT? A LITERATURE REVIEW

Damian Czepita , Ewa Łodygowska , Maciej Czepita

A review of the literature concerning the relationship between refractive errors and IQ was done. In 1958 Nadell and Hirsch found that children in America with myopia have a higher IQ. A similar relationship has been described by other researchers from the USA, the Czech Republic, Denmark, Israel, New Zealand, and Singapore. In other related studies, it was reported that myopic children regardless of their IQ gain better school achievements . It was also observed that schoolchildren with hyperopia have a lower IQ and gain worse school achievements . The conducted clinical observations suggest that children with myopia may have a higher IQ. This relationship is most probably determined by genetic and environmental factors.

3. THE ASSOCIATION BETWEEN SCHOOLCHILDREN INTELLIGENCE AND REFRACTIVE ERROR

A Akrami [1], N Bakmohammadi, M Seyedabadi, I Nabipour, Z Mirzaei, S Farrokhi, M Assadi

The relationship between refractory errors and intelligence and the importance of genetic, regional and environmental factors in such associations, were investigated in a group of school children. One hundred and thirty-seven students (34.3% boys and 65.7% girls) from two primary schools were enrolled in the study. Seventy-eight (56.9%) of subjects showed a form of refractory error; 27%, 3% and 2.9% were myope, hyperope or astigmat, respectively, whereas 12.4% of them had both myopia and astigmatism and 10.2% showed hyperopia and astigmatism; 43.1% were normal. Although our data revealed no distinction of average score between normal group and myopia, hyperopia, astigmatism or hyperopia-astigmatism, there

is a statistically significant difference between normal group and those who had both myopia and astigmatism in which the later had a lower mediocre.

AIM OF THE STUDY

The aim of this study is to find the correlation between intelligence quotients ,refractive error and other ocular factors.

OBJECTIVES

- To calculate Intelligence quotients (IQ) Score by assessing IQ questionnaire (By Glenn Wilson & Diana Grylls)

-To Mainly identify the relation between IQ and Refractive error. (In Myopic childrens)

MATERIALS AND METHODOLOGY

MATERIALS

- **Study Design :**

  Prospective Study

- **Study site:**

  Narayana nethralaya 2,bangluru ,Karnataka

- **Sampling Method:**

  Universal Sampling

- **Study Period**:

  Dec 2019-april 2020

- **Sample Size**:

  58

- **Subjects:**

Inclusion Criteria:

1. Children age < 5 to 12 years
2. Myopia of >-0.50D to -6.00D
3. Astigmatism -0.50
4. Anisometropia<1.00D

Exclusion Criteria:

1. Children age <13years
2. Amblyopia
3. All tropias and esophoria
4. Neurological deficit
5. Hyperopes

METHODOLOGY

Current prospective study was designed using 58 subjects (116 eyes respectively) at Narayana Nethralaya, Bangalore, India during the period of Dec 2019 to April 2020. 58 subjects (116 eyes) within the age group of 05 to 12 years were screened .Patients above age of 12 years with BV anomalies, strabismus, amblyopia, and anisometropia<1.00 D, neurological deficit and hyperopes were excluded from the study.
Myopia>-0.50D to -6.00D, astigmatism -0.50 were included in this study.
Each patient was explained about the purpose and procedures and the time involved for the completion of course of action. A verbal consent was obtained from each patient parents prior to involvement in the study.

Ethics and consent

1.Approval was taken prior to the study from the institute and from tertiary eye care centre.

2.Subjects were informed about the duration and procedure of the study.

The methodology was divided into 4 steps.

1. Detailed history was taking (including reading books per week)

2. Dry retinoscopy and subjective refraction

3. IQ questionnaires

4. Taking ocular parameter with using of Pentacam & IOL Master

In this study, following procedures were carried out:

1. Seating patients comfortably then taking detailed history

2. Visual acuity (VA) assessment was done with the help of Snellen's chart at 6m distance. Dry Retinoscopy was done followed by subjective refraction.

3. IQ- questionnaire

A questionnaire by Glenn Wilson & Diana Grylls , consisting of one eighty questions to assess the intelligences of a child was used in this study , The questionnaire was made in English and translated into Hindi without any loss of meaning of the questionnaire during translation.

Questionnaire are divied into five quotient (Test) –

Test 1: VOCABULARY
Test 2: CLASSIFICATION
Test 3: OBSERVATION
Test 4: SCIENTIFIC UNDERSTANDING
Test 5: PATTERN COMPLTION

After that INTERPRETATION OF SCORES are done in which first of all create childrens 'Intelligence profile 'on behalf of above five test .
The best estimate of the child's overall IQ is the median of the five scores ,that is the scores that falls in the middle if the five quotients are put in rank order. This is

preferred over the usual method of calculating an average for several resons, one being that it takes less account of the extremes .
Intelligence quotients (IQ) are interpreted as follows:

ABOVE 140	VERY SUPERIOR
120-140	SUPERIOR
110-120	HIGH AVERAGE
90-110	AVERAGE
80-90	LOW AVERAGE
70-80	BORDERLINE
BELOW 70	MENTALLY RETARDED

4. Taking ocular parameter

Corneal curvature, axial length, CCT and anterior chamber depth (ACD) types of datas sourced from Pentacam and IOL Master .

All data collected was entered in Microsoft Excel. Statistical analysis (KRUSKAL-WALLIS TEST) and IQ questionnaire were analyzed using mean and standard deviation .

RESULTS

DATA ANALYSIS

TABLE 1: IQ AND REFRACTIVE ERROR

Kruskal-Wallis test

Data	INTELLIGENCE_QUOTIENTS
Factor codes	Group

Sample size	58

Descriptive statistics

Factor	n	Minimum	25th percentile	Median	75th percentile	Maximum
MYOPIA	28	82.0000	93.000	100.000	113.500	135.000
NORMAL	30	84.0000	88.000	95.000	98.000	102.000

Kruskal-Wallis test

Test statistic	8.8332

Corrected for ties Ht	8.8892
Degrees of Freedom (DF)	1
Significance level	P = 0.002869

Factor	N	Average Rank
(1) MYOPIA	28	36.32
(2) NORMAL	30	23.13

GRAPH:- IQ AND REFRACTIVE ERROR (MYOPIA AND NORMAL GROUP)

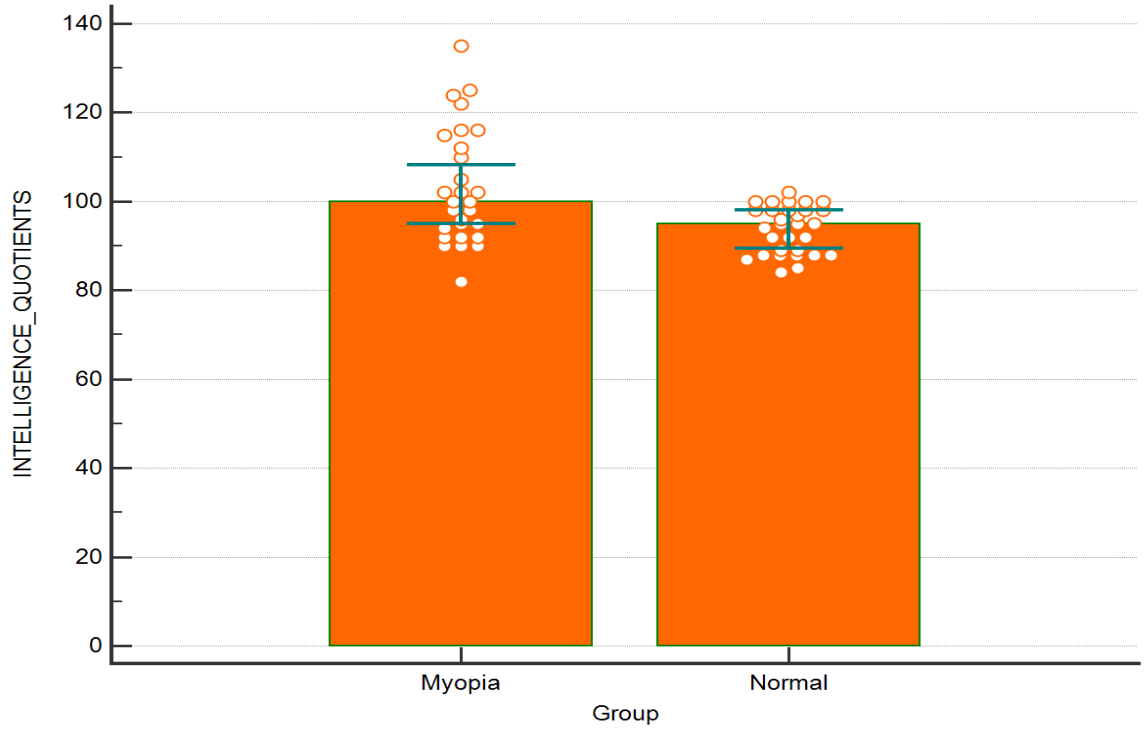


TABLE 2 : IQ AND OTHER OCULAR FACTOR (AXIAL LENGTH ,CORNEAL CURVATURE ,CCT ,ACD)

INTELLIGENCE_QUOTIENTS	82				84			
	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
ACD_IN_MM__OD_	3.2				3.01			
ACD_IN_MM__OS_	3.21				3.12			
AXIAL_LENGTH_IN_MM_OD_	23.68				23.57			
AXIAL_LENGTH_IN_MM_OS_	23.62				23.52			
CCT_IN_MICRON_MM_OD_	541				555			
CCT_IN_MICRON_MM_OS_	551				565			
CORNEAL_CURVATURE_IN_MM___OD__AVG_	7.41				7.13			
CORNEAL_CURVATURE_IN_MM___OS__AVG_	7.37				7.33			

85				87				88			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.1				3				3.042	2.922 to 3.162	0.09628	0.04306
3.3				3				3.008	2.950 to 3.066	0.04658	0.02083
24.12				24.52				23.762	22.867 to 24.657	0.7207	0.3223
23.92				24.6				23.694	22.838 to 24.550	0.6891	0.3082
535				545				532.2	521.686 to 542.714	8.4676	3.7868
539				540				540.2	523.788 to 556.612	13.2174	5.911
7.52				7.49				7.456	7.065 to 7.847	0.3151	0.1409
7.14				7.71				7.304	6.839 to 7.769	0.3749	0.1676

89				90				92			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.015	2.824 to 3.206	0.02121	0.015	3.637	3.401 to 3.873	0.09504	0.05487	3.288	3.025 to 3.551	0.2506	0.1023
3.15	2.515 to 3.785	0.07071	0.05	3.597	3.309 to 3.885	0.1159	0.06692	3.36	3.119 to 3.601	0.2297	0.09377
23.74	18.912 to 28.568	0.5374	0.38	24.917	23.694 to 26.139	0.4922	0.2842	24.032	23.677 to 24.386	0.3378	0.1379
23.86	20.048 to 27.672	0.4243	0.3	24.793	23.656 to 25.931	0.4579	0.2643	24.09	23.597 to 24.583	0.4698	0.1918
537.5	442.203 to 632.797	10.6066	7.5	520	453.297 to 586.703	26.8514	15.5027	537	499.384 to 574.616	35.8441	14.6333
535	535.000 to 535.000	0	0	518.667	451.258 to 586.075	27.1355	15.6667	530.833	495.553 to 566.113	33.618	13.7245
7.705	2.051 to 13.359	0.6293	0.445	7.6	7.071 to 8.129	0.2128	0.1229	7.625	7.180 to 8.070	0.4243	0.1732
7.99	4.432 to 11.548	0.396	0.28	7.613	7.144 to 8.082	0.1888	0.109	7.643	7.182 to 8.105	0.4395	0.1794

94				95				96			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.25	0.455 to 6.045	0.3111	0.22	3.032	2.967 to 3.097	0.05263	0.02354	3.365	-1.146 to 7.876	0.5020	0.355
3.165	-0.837 to 7.167	0.4455	0.315	3.064	2.979 to 3.149	0.06841	0.03059	3.37	-1.840 to 8.580	0.5798	0.41
24.005	15.809 to 32.201	0.9122	0.645	24.828	22.775 to 26.881	1.6536	0.7395	24.495	18.968 to 30.022	0.6152	0.435
23.935	11.801 to 36.069	1.3506	0.955	24.768	22.794 to 26.742	1.59	0.7111	24.79	17.929 to 31.651	0.7637	0.54
513	195.345 to 830.655	35.3553	25	563	515.240 to 610.760	38.4643	17.2017	530.5	333.554 to 727.446	21.9203	15.5
519.5	195.492 to 843.508	36.0624	25.5	562.2	525.289 to 599.111	29.7271	13.2944	513.5	303.848 to 723.152	23.3345	16.5
7.335	7.271 to 7.399	0.007071	0.005	7.774	7.434 to 8.114	0.2739	0.1225	7.65	7.396 to 7.904	0.02828	0.02
7.485	4.626 to 10.344	0.3182	0.225	7.656	7.205 to 8.107	0.3633	0.1625	7.785	6.197 to 9.373	0.1768	0.125

97				98				100			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
2.98				3.226	2.951 to 3.501	0.2974	0.1124	3.131	2.994 to 3.269	0.1483	0.05604
3.08				3.183	2.914 to 3.452	0.2911	0.11	3.08	2.943 to 3.217	0.1479	0.05589
23.03				24.119	23.832 to 24.405	0.3095	0.117	23.937	23.370 to 24.505	0.6137	0.2319
23.19				24.163	23.920 to 24.406	0.2629	0.09937	23.879	23.186 to 24.571	0.7485	0.2829
530				533.286	513.380 to 553.191	21.523	8.1349	534.429	527.169 to 541.688	7.8498	2.9669
525				529	511.114 to 546.886	19.3391	7.3095	531.857	524.606 to 539.109	7.8407	2.9635
7.62				7.731	7.412 to 8.051	0.3452	0.1305	7.61	7.288 to 7.932	0.3482	0.1316
7.59				7.711	7.343 to 8.080	0.3981	0.1505	7.65	7.401 to 7.899	0.2698	0.102

102				105				110			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.205	2.846 to 3.564	0.2258	0.1129	3.68				3.02			
3.195	2.791 to 3.599	0.2541	0.127	3.58				3			
23.723	21.957 to 25.488	1.1093	0.5547	25.9				24.25			
23.742	21.632 to 25.853	1.3266	0.6633	25.58				24.19			
543.75	489.971 to 597.529	33.7972	16.8986	561				539			
549.25	502.147 to 596.353	29.6015	14.8008	558				550			
185.835	-381.876 to 753.546	356.7767	178.3883	8.01				7.32			
7.453	7.176 to 7.729	0.1739	0.08693	7.92				7.32			

112				115				116			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.28				3.75				3.105	2.914 to 3.296	0.02121	0.015
3.33				3.69				3.09	2.836 to 3.344	0.02828	0.02
25.18				24.57				24.33	19.120 to 29.540	0.5798	0.41
25.13				24.34				24.18	19.352 to 29.008	0.5374	0.38
575				553				536.5	504.734 to 568.266	3.5355	2.5
578				564				538.5	494.028 to 582.972	4.9497	3.5
7.66				7.69				7.605	5.508 to 9.702	0.2333	0.165
7.72				7.68				7.705	5.354 to 10.056	0.2616	0.185

122				124			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.56				3.09			
3.57				3.15			
26.23				25.16			
26.21				24.68			
513				568			
521				561			
7.73				7.28			
7.7				7.26			

125				135			
Mean	95% CI	SD	SEM	Mean	95% CI	SD	SEM
3.5				3.59			
3.5				3.49			
25.85				24.31			
26.06				24.56			
503				563			
509				564			
7.26				7.55			
7.25				7.6			

RESULT :

1. Total 58 subject (116 eyes) were included in the study out of which 28 myopic and 30 emmetropic . the range of age was 5 to 12 years . the average was 8-9 years .

2. The mean refractive error was -4.50 (SD 2.09; range, 10.06 to 1.56), mean axial length was 24.53mm (SD 1.09 ; range, 27.57–22.39), and IQ correlated with refractive error (Spearman correlation coefficient, r 0.74). There was a lag between study entry and the IQ phase of the study, The median number of books read per week was 10 ; 25 children read no books per week, 14 children read one book per week, 10 read two books per week, 7 read three books per week, and 2 read four or more books per week.

3. In the TABLE.1 statistical analysis (KRUSKAL-WALLIS TEST) distinctly shows the significant relation (P= 0.002869) between MYOPIC CHILDRENS and INTELLIGENCE QUOTIENTS(IQ) as compare to normal group of children .

4. In the component bar diagram (graph) are shows Intelligence score (IQ) in both the group myopic as well as normal (emmetropic) respectively.

5. In the TABLE.2 shows the correlation between Intelligence quotients (IQ) and ocular components axial length , corneal curvature ,CCT ,ACD (anterior chamber depth) .

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DISCUSSION

This is the study to evaluate the level of intelligence is more in myopic child then the normal or emmetropic child . myopia in school going children is places very different roles in their life .

This study shows that children with myopia has ability of problem solving , reading and writing and their attitude are also differ from the other children . it reflect some of children are very deep thinkers , quick answering also using their logical/mathematical intelligence is more then the other .

Along with in myopic axial length was greater because of axial myopia ,and curvature are also change because of curvature myopia but in Corneal center thickness (CCT) and anterior chamber depth (ACD) is not very much difference are seen.

So there is significance difference of intelligence quotients in myopic and normal children, now we can say myopic childrens are more intelligent then normal(emmetropic) childrens.

There were 58 children who answered the questionnaire consisting of 28 myopic and 30 normal (emmetropic), The majority of children were myopic and normal . 56.90% were not aware about intelligence quotients (IQ) on regular basis whereas 43.10% were aware.

Indian children aged 5 to 12 years with higher IQ, as measured by the GLENN WILSON AND DIANA GRYLLS, were more likely to be myopic, after controlling books read per week. Higher IQ scores were also associated with greater axial lengths. Our data suggest that IQ has an association with myopia independent of near work in young students though the mechanism underlying the nonverbal IQ-myopia relationship is not well understood. An interesting observations is that myopia is not significantly associated with books read per week .

A positive association of myopia with higher academic performance, reading ability, and IQ test scores has long been recognized, of which only a few examples will be cited here. Cohn et al.20 noted a century ago that persons who were intellectually gifted or scholarly were more likely to be myopic.

Previous study done by Seang-Mei Saw; Say-Beng Tan; Daniel Fung; Kee-Seng Chia; David Koh; Donald T. H. Tan; Richard A. Stone , To evaluate the association between intelligence and myopia in children. 1204 Chinese school children aged 10 to 12 years from three schools who were participants in the Singapore Cohort Study Of the Risk Factors for Myopia (SCORM).

Intelligence quotient (IQ) was assessed using the nonverbal Raven Standard Progressive Matrix test. All children from grades 1 to 3 from three "normal" schools located in the Southeastern, Western, and Northern parts of Singapore were invited to join this study in 1999 and 2001. The children who participated in SCORM completed a nonverbal IQ test on the school's premises in 2002, using the Raven Standard Progressive Matrices. Strengths of their study include a large sample size, the use of a nonverbal IQ test, adjustments for reading as a confounder, and the availability of ocular biometry parameter measures. In addition, there are limited confounding effects of age on the nonverbal IQ-myopia association, because the majority of the children (77%) were 10 years old.
There are several limitations in their study that the cross-sectional nature of the study does not allow inferences regarding possible causal relationships. The participation rate in SCORM is 66.3%, and false results may be present if the nonverbal IQ-myopia association is different among participants compared with nonparticipants. This participant bias seems unlikely, because the percentage of children who report near-sightedness is similar among participants and nonparticipants. .

Despite the study of mine, in this article –(IQ and the Association with Myopia in Children by
Seang-Mei Saw; Say-Beng Tan; Daniel Fung; Kee-Seng Chia; David Koh; Donald T. H. Tan; Richard A. Stone.) I found some more essential statements that encourages me to go through this topic and to found new things so I took children between the age of 5 to12 and also in the place of (nonverbal Raven Standard Progressive Matrix test). I took this book (Know Your Child's IQ by Glenn Wilson & Diana Grylls), because in this book IQ test are very simplified, tests are designed to overcome these two biases, either have a moron or an exceptional genius on their hands For another, they have limited experience of the intelligence of other children,
In my thought intelligence is not only the capabilities that are relevant to scholastic performances. It is involves the ability to reason, plan, solve problems,

how to deal with circumstances that they are facing in daily routine, think abstractly, comprehend complex ideas, learn quickly, and learn from experience. So this book is basing their concept of what is average on other children in the family and perhaps a few other local kids. This test is very simplified containg type of objective, observation, some incomplete pattern like questions, odd-ones and also based on some scientific daily life observations .
These all questionnaire was made in English and translated into Hindi without any loss of meaning of the questionnaire during translation.

Also taking the ocular parameter corneal curvature ,axial length by using Pantacam machine, it is very advanced machine . data accuracy is very good .

- **LIMITATION:**

-this study included a small number of participants

- the sampling design was purposive the results might not be representative of the overall people

CONCLUSION

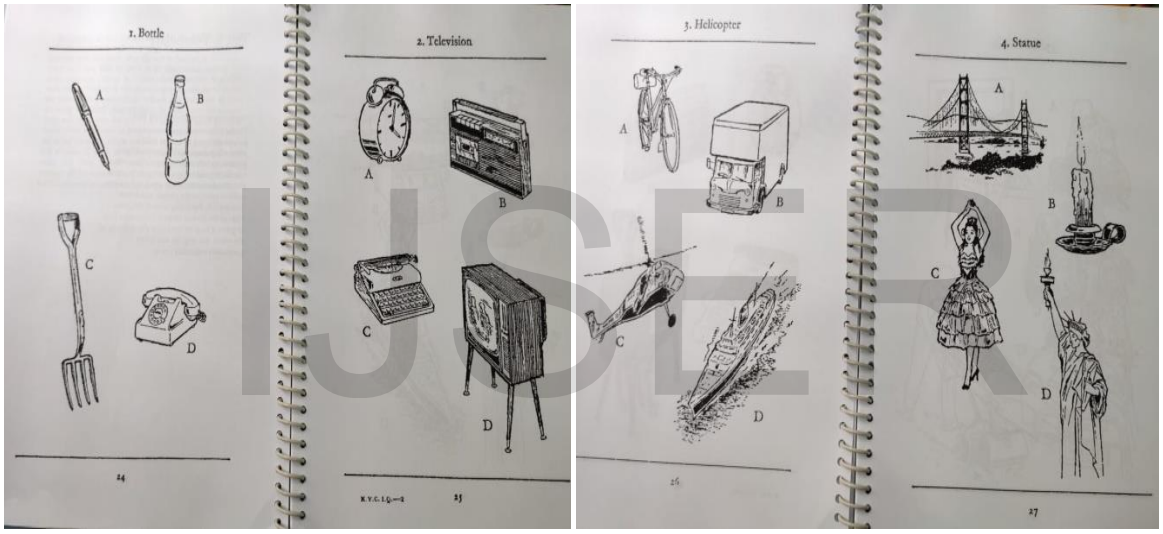
So this study shows that Intelligence quotients (IQ) is correlated with refractive error ,axial length, corneal curvature ,corneal curvature thickness(CCT), and anterior chamber depth(ACD). Myopic children are more intelligent from normal (emmetropic) children , along with this in myopia greater axial length , corneal curvature are also takes place.

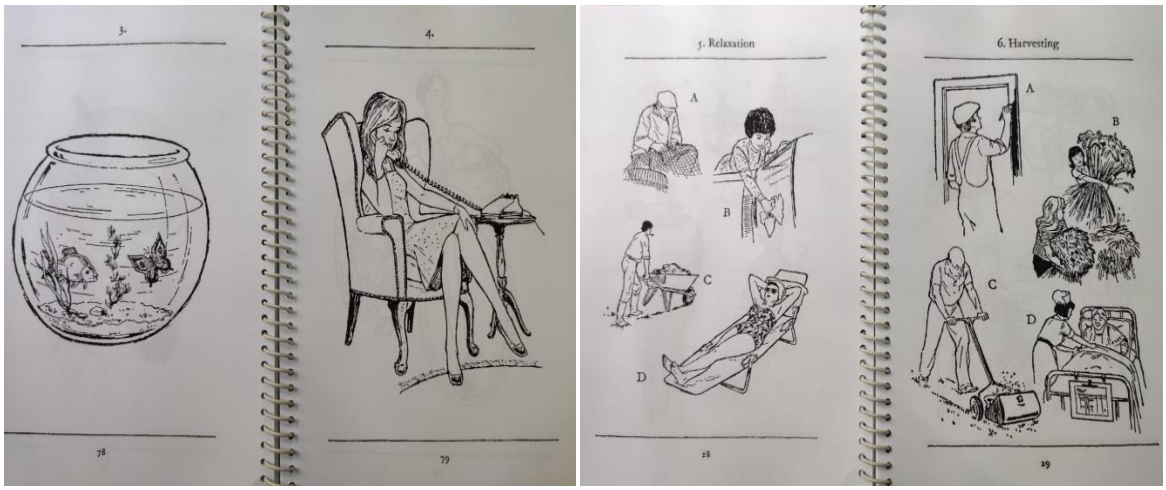
INTELLIGENCE QUOTIENTS(IQ) QUESTIONNAIRE

Contents

Test I: Vocabulary

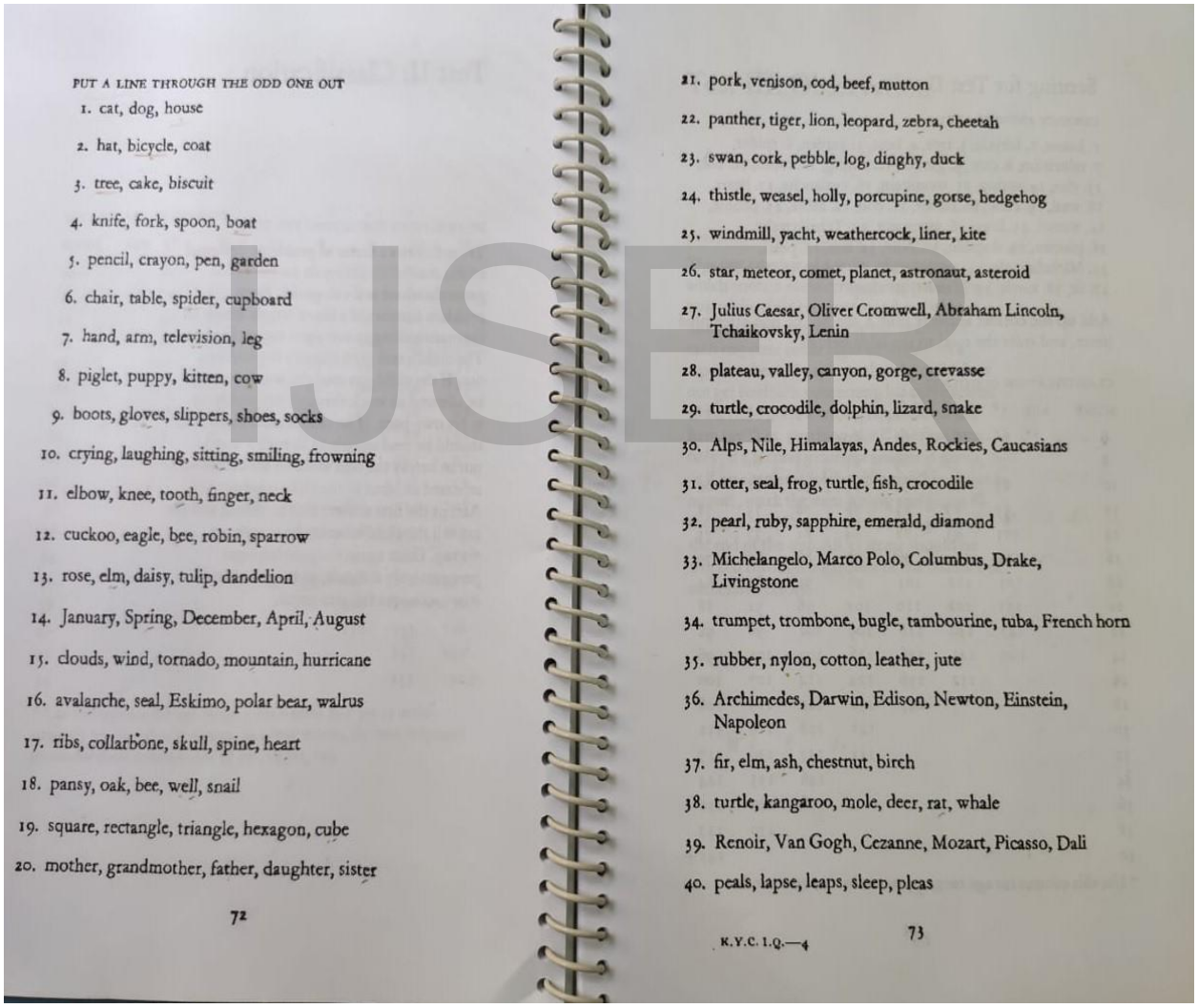
These types of question are asked to children for survey , in this children has to choose the correct thing . some of the examples are given as follows……





Test II: Classification

In this children has to choose the Odd one . list of questions are given as follows……



PUT A LINE THROUGH THE ODD ONE OUT

1. cat, dog, house
2. hat, bicycle, coat
3. tree, cake, biscuit
4. knife, fork, spoon, boat
5. pencil, crayon, pen, garden
6. chair, table, spider, cupboard
7. hand, arm, television, leg
8. piglet, puppy, kitten, cow
9. boots, gloves, slippers, shoes, socks
10. crying, laughing, sitting, smiling, frowning
11. elbow, knee, tooth, finger, neck
12. cuckoo, eagle, bee, robin, sparrow
13. rose, elm, daisy, tulip, dandelion
14. January, Spring, December, April, August
15. clouds, wind, tornado, mountain, hurricane
16. avalanche, seal, Eskimo, polar bear, walrus
17. ribs, collarbone, skull, spine, heart
18. pansy, oak, bee, well, snail
19. square, rectangle, triangle, hexagon, cube
20. mother, grandmother, father, daughter, sister

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21. pork, venison, cod, beef, mutton
22. panther, tiger, lion, leopard, zebra, cheetah
23. swan, cork, pebble, log, dinghy, duck
24. thistle, weasel, holly, porcupine, gorse, hedgehog
25. windmill, yacht, weathercock, liner, kite
26. star, meteor, comet, planet, astronaut, asteroid
27. Julius Caesar, Oliver Cromwell, Abraham Lincoln, Tchaikovsky, Lenin
28. plateau, valley, canyon, gorge, crevasse
29. turtle, crocodile, dolphin, lizard, snake
30. Alps, Nile, Himalayas, Andes, Rockies, Caucasians
31. otter, seal, frog, turtle, fish, crocodile
32. pearl, ruby, sapphire, emerald, diamond
33. Michelangelo, Marco Polo, Columbus, Drake, Livingstone
34. trumpet, trombone, bugle, tambourine, tuba, French horn
35. rubber, nylon, cotton, leather, jute
36. Archimedes, Darwin, Edison, Newton, Einstein, Napoleon
37. fir, elm, ash, chestnut, birch
38. turtle, kangaroo, mole, deer, rat, whale
39. Renoir, Van Gogh, Cezanne, Mozart, Picasso, Dali
40. peals, lapse, leaps, sleep, pleas

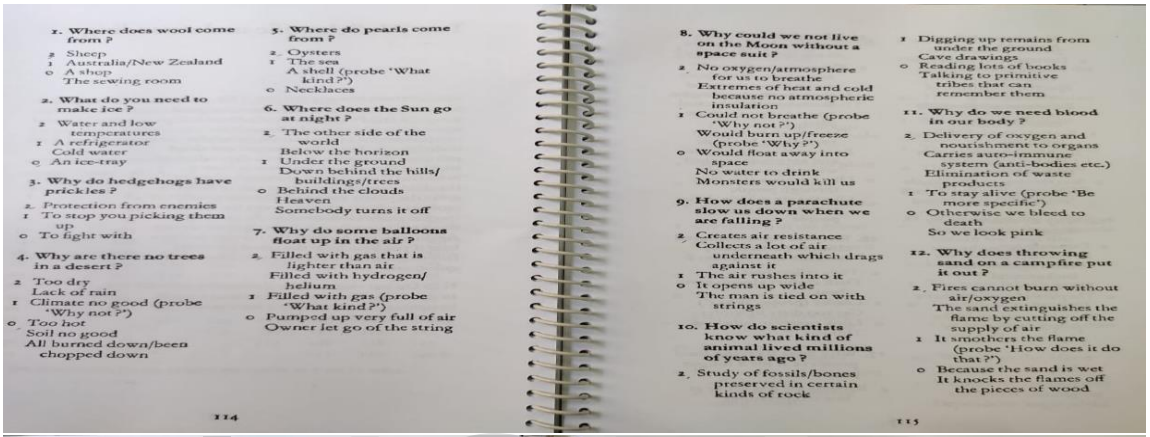
K.Y.C. I.Q.—4 73

Test III: Observation

In this children has to observe the missing thing . some of the examples are given as follows……

Test IV: Scientific understanding

In this children has to choose the correct answer . examples are given as follows……



1. Where does wool come from ?
2 Sheep
1 Australia/New Zealand
0 A shop
The sewing room

2. What do you need to make ice ?
2 Water and low temperatures
1 A refrigerator
Cold water
0 An ice-tray

3. Why do hedgehogs have prickles ?
2 Protection from enemies
1 To stop you picking them up
0 To fight with

4. Why are there no trees in a desert ?
2 Too dry
Lack of rain
1 Climate no good (probe 'Why not ?')
0 Too hot
Soil no good
All burned down/been chopped down

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5. Where do pearls come from ?
2 Oysters
1 The sea
A shell (probe 'What kind ?')
0 Necklaces

6. Where does the Sun go at night ?
2 The other side of the world
Below the horizon
1 Under the ground
Down behind the hills/buildings/trees
0 Behind the clouds
Heaven
Somebody turns it off

7. Why do some balloons float up in the air ?
2 Filled with gas that is lighter than air
Filled with hydrogen/helium
1 Filled with gas (probe 'What kind ?')
0 Pumped up very full of air
Owner let go of the string

8. Why could we not live on the Moon without a space suit ?
2 No oxygen/atmosphere for us to breathe
Extremes of heat and cold because no atmospheric insulation
1 Could not breathe (probe 'Why not ?')
Would burn up/freeze (probe 'Why ?')
0 Would float away into space
No water to drink
Monsters would kill us

9. How does a parachute slow us down when we are falling ?
2 Creates air resistance
Collects a lot of air underneath which drags against it
1 The air rushes into it
0 It opens up wide
The man is tied on with strings

10. How do scientists know what kind of animal lived millions of years ago ?
2 Study of fossils/bones preserved in certain kinds of rock

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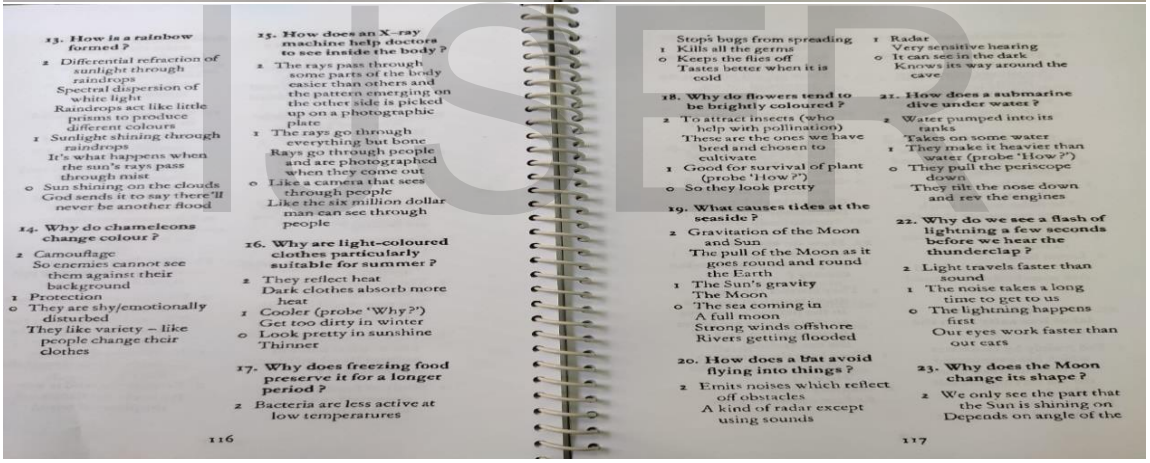
1 Digging up remains from under the ground
Cave drawings
0 Reading lots of books
Talking to primitive tribes that can remember them

11. Why do we need blood in our body ?
2 Delivery of oxygen and nourishment to organs
Carries auto-immune system (anti-bodies etc.)
Elimination of waste products
1 To stay alive (probe 'Be more specific')
0 Otherwise we bleed to death
So we look pink

12. Why does throwing sand on a campfire put it out ?
2 Fires cannot burn without air/oxygen
The sand extinguishes the flame by cutting off the supply of air
1 It smothers the flame (probe 'How does it do that ?')
0 Because the sand is wet
It knocks the flames off the pieces of wood



13. How is a rainbow formed ?
2 Differential refraction of sunlight through raindrops
Spectral dispersion of white light
Raindrops act like little prisms to produce different colours
1 Sunlight shining through raindrops
It's what happens when the sun's rays pass through mist
0 Sun shining on the clouds
God sends it to say there'll never be another flood

14. Why do chameleons change colour ?
2 Camouflage
So enemies cannot see them against their background
1 Protection
0 They are shy/emotionally disturbed
They like variety – like people change their clothes

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15. How does an X-ray machine help doctors to see inside the body ?
2 The rays pass through some parts of the body easier than others and the pattern emerging on the other side is picked up on a photographic plate
1 The rays go through everything but bone
Rays go through people and are photographed when they come out
0 Like a camera that sees through people
Like the six million dollar man can see through people

16. Why are light-coloured clothes particularly suitable for summer ?
2 They reflect heat
Dark clothes absorb more heat
1 Cooler (probe 'Why ?')
Get too dirty in winter
0 Look pretty in sunshine
Thinner

17. Why does freezing food preserve it for a longer period ?
2 Bacteria are less active at low temperatures

Stops bugs from spreading
1 Kills all the germs
0 Keeps the flies off
Tastes better when it is cold

18. Why do flowers tend to be brightly coloured ?
2 To attract insects (who help with pollination)
These are the ones we have bred and chosen to cultivate
1 Good for survival of plant (probe 'How ?')
0 So they look pretty

19. What causes tides at the seaside ?
2 Gravitation of the Moon and Sun
The pull of the Moon as it goes round and round the Earth
1 The Sun's gravity
The Moon
0 The sea coming in
A full moon
Strong winds offshore
Rivers getting flooded

20. How does a bat avoid flying into things ?
2 Emits noises which reflect off obstacles
A kind of radar except using sounds

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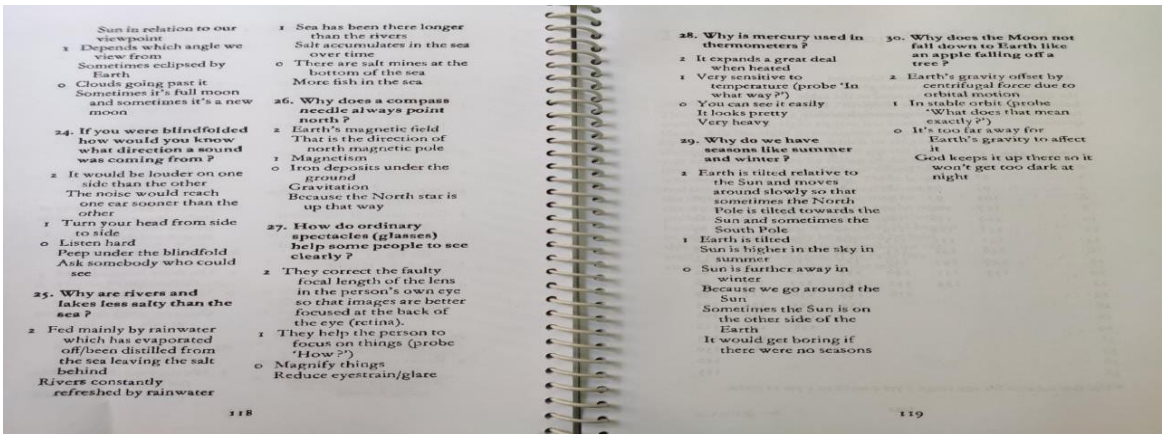
1 Radar
Very sensitive hearing
0 It can see in the dark
Knows its way around the cave

21. How does a submarine dive under water ?
2 Water pumped into its tanks
Takes on some water
1 They make it heavier than water (probe 'How ?')
0 They pull the periscope down
They tilt the nose down and rev the engines

22. Why do we see a flash of lightning a few seconds before we hear the thunderclap ?
2 Light travels faster than sound
1 The noise takes a long time to get to us
0 The lightning happens first
Our eyes work faster than our ears

23. Why does the Moon change its shape ?
2 We only see the part that the Sun is shining on
Depends on angle of the



Sun in relation to our viewpoint
1 Depends which angle we view from
Sometimes eclipsed by Earth
0 Clouds going past it
Sometimes it's full moon and sometimes it's a new moon

24. If you were blindfolded how would you know what direction a sound was coming from ?
2 It would be louder on one side than the other
The noise would reach one ear sooner than the other
1 Turn your head from side to side
0 Listen hard
Peep under the blindfold
Ask somebody who could see

25. Why are rivers and lakes less salty than the sea ?
2 Fed mainly by rainwater which has evaporated off/been distilled from the sea leaving the salt behind
Rivers constantly refreshed by rainwater

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1 Sea has been there longer than the rivers
Salt accumulates in the sea over time
0 There are salt mines at the bottom of the sea
More fish in the sea

26. Why does a compass needle always point north ?
2 Earth's magnetic field
That is the direction of north magnetic pole
1 Magnetism
0 Iron deposits under the ground
Gravitation
Because the North star is up that way

27. How do ordinary spectacles (glasses) help some people to see clearly ?
2 They correct the faulty focal length of the lens in the person's own eye so that images are better focused at the back of the eye (retina).
1 They help the person to focus on things (probe 'How ?')
0 Magnify things
Reduce eyestrain/glare

28. Why is mercury used in thermometers ?
2 It expands a great deal when heated
1 Very sensitive to temperature (probe 'In what way ?')
0 You can see it easily
It looks pretty
Very heavy

29. Why do we have seasons like summer and winter ?
2 Earth is tilted relative to the Sun and moves around slowly so that sometimes the North Pole is tilted towards the Sun and sometimes the South Pole
1 Earth is tilted
Sun is higher in the sky in summer
0 Sun is further away in winter
Because we go around the Sun
Sometimes the Sun is on the other side of the Earth
It would get boring if there were no seasons

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30. Why does the Moon not fall down to Earth like an apple falling off a tree ?
2 Earth's gravity offset by centrifugal force due to orbital motion
1 In stable orbit (probe 'What does that mean exactly ?')
0 It's too far away for Earth's gravity to affect it
God keeps it up there so it won't get too dark at night

Test V: Pattern completion

In this children has to fill the correct pattern. Some of examples are given as follows……