Cognitive Schema of Net-generation College Students: An Empirical Study from Three Universities

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Abstract

The current popularization of the Internet and digital technology, which leads to the 'digital existence' of people, has overturned the traditional lifestyle. The digital existence of Net-generation college students may lead to corresponding changes in their cognitive schema, thus putting forward new expectations and visions for college classes. Based on Piaget's epistemology, this study evaluates 395 students from three colleges and universities. The assessment includes cognitive schema from perception, attention, memory and thought processing. Data analysis, by SPSS, includes frequency table, weighted average, difference analysis by ANOVA/T-test, and correlation analysis by Pearson coefficient r. Results show that the Net-generation college students' cognitive schemata are showing a certain 'digital evolution' and 'digital dementia' in four dimensions, including acute awareness of visual audio but weaker text perception, the multitasking attention mode but short-time concentrate, Strong short-term and operational memory but more dependent on external storage, strong jumping thinking and associative ability but weak deep thinking ability. Qualitative research based on teacher interviews confirms the quantitative assessment of cognitive schemata of the respondents. The discussions include teachers' preparation in terms of concepts, roles, and information technology, as well as the balance between students' paper-based reading and online resource retrieval, and the reform of teaching mode.

Keywords: *Cognitive schema, net-generation, college students, empirical study*

I. Introduction

Contemporary Chinese college students, who have grown up surrounded by the Internet and digital devices, have changed their living mode and behaviors accordingly, who are known as Digital Natives or Net-generation [1]. Net-generation College students are using digital devices and networks as much as air and water, which is a phenomenon known as 'digital survival' [2]. According to the viewpoint of epistemology, the change of specific cognitive situation or behavioral pattern may cause the change or reconstruction of cognitive schema. Cognitive schema, a relatively stable mode of thinking or action, is the basic framework for people to acquire and understand new knowledge, analysis and reasoning [3].

So, has the online existence of China's College students in internet era cause changes in their cognitive schema? Because Chinese college students are so active in online interaction, who has become the main force of Chinese netizens, but they are often distracted, not engaged, and unable to stop playing mobile phones in class. Is it because the existing teaching method does not correspond to their cognitive schema? The study, as a preliminary exploring, originates from the above questions.

In order to discuss the above issues, the project will carry out the following works. Preliminary research is to understand the classic theories and latest progress of relevant research on this theme. Questionnaire aims to know the cognitive schema of Net-generation college students in Hunan Province, China. Interview, as a supplement, is then used to visit teachers for sharing their observation on students' cognitive schema. SPSS will be used to process and analyze the data and coding will be used to summarize responses from interviews. As an output, college teachers' idea changing, teaching mode reform are to be discussed.

II. The Problem and Its Background

2.1 Background of the study

The term cognitive schema or cognitive structure is a reference to the cognitive theory of the Swiss psychologist Piaget. The term schema describes the mode or psychological structure of people's representation, organization and interpretation of experience [4]. It is a relatively stable mode of a person's concept and consciousness, a basic framework for people to acquire and understand new knowledge. Combined with the classical cognitive psychology theory and the target of the study, cognitive schema or cognitive structure can be simply divides into four levels of perception, attention, memory and thinking ability [5].

Net-generation generally refers to the generation that has grown up in the Internet age. The concept of Net-generation or Digital Natives was first proposed by American educator Marc Prensky in 2001, and he has made pro-and-con distinctions between Digital Natives (people born with access to Digital devices and networks) and Digital immigrants (people coming of age with access to Digital devices) [6]. He's argued that teaching is no longer appropriate to who are being taught because students have changed radically, which has been a discontinuity, or singularity. Canadian scholar Tapscott calls this generation Net-generation, while similar terms will be like N-generation and Millennials [7]. These concepts, in essence, refer to a new generation of individuals who have grown up with digital technology. The concept Net-generation mentioned in this study refers to the children who have grown up with the popularization of broadband network in China and have been using various networked devices since childhood. China's Net-generation, which can be called the second generation of digital natives, differs from the first digital generation in its use of the Internet and decentralized cooperation in online activities [7].

At present, College students in China are the real Net-generation. In China, since about 1994 a few high-income families have started to install computers, but till around 2000-2010, the Asymmetrical Digital Subscriber Loop broadband network developed rapidly. By 2019, China had built the world's largest optical fiber and mobile communication network with optical fiber and 4th Generation networks. On April 28, 2020, China Internet Network Information Center (CNNIC) released the 45th Statistical Report, showing that the Internet penetration rate of 64.5%. The number of online education users in China was 423 million, accounting for 46.8% of the netizens [8]. From above trajectories, most of the current college students in China were born around 2000, so they are real networked native generation in China. It is this age group that has grown up surrounded by the Internet and digital devices since they were born. Their life, learning, entertainment and communication are all inseparable from the Internet and intelligent digital devices. They are truly networked. From this data it can be estimated that digital immigrants make up the majority of college teachers.

'Different experiences or environments produce different brain structures', says Dr. Bruce D. Parry. While with the arrival of the Net-generation of college students, college classrooms now face some challenges. It can be divided into three aspects on teaching resources, teaching environment and teaching methods. Their online interaction is often characterized by freedom, openness, equality, inclusiveness, and anonymity. Maybe accustomed to online interaction, they tend to be less engaged in the classroom, lacking patience and concentration. At present, China's university education is in a difficult period of reform. As indicated above, hardware upgrading and simple changes in teaching cannot significantly improve college students' learning. It is necessary to pay attention to the cognitive characters of college students and explore it.

2.2 Review of related literature

There has been a deal of research on the subject of the Net-generation. Autry and Alex (2011) furtherly compared the groups of digital natives and digital immigrants [9]. International Telecommunication Union (ITU) (2012) has clarified its definition and has constructed a model to calculate the scale of digital natives. Joiner et al. (2013) has

compared the first and second generations of digital natives and point out that the second generation is more networked [9]. H. Hua (2019) explored the understanding gap between them and digital immigrants [10].

Research in the field of Net-generation's cognition has focused on the heterogeneity of cognition and behavior from other groups: in 2010 a team of MITechnology began analyzing children's online behavior and cognition [9]. The 2010 CHILDHWISE Digital Life Report pointed out that children in the digital world can no longer understand what it would be like to live without the Internet [9]. Nie Ying (2016) compared the cognitive thresholds of Net-generation and digital immigrants, and believed that there were group differences between them [7]. Fu Shuang (2017) took a university in Wuhan as an example to explore the behavioral characteristics of information collection and screening of college students in the Net-generation [11]. Scientists, such as neuroscientists from Harvard University in the United States, also studied the differences in cognitive functions and characteristics from the perspective of neuroanatomy. They believed that the use of networked devices significantly improved the attention balance and distribution ability of children and made them respond more quickly [9]. Zhao Yuxiang(2014) found that students in the Net-generation can master the use of various digital devices quickly, based on the concept of digital savvy, he put forward an optimistic assumption of their cognitive ability, namely 'digital evolution' [12]. The critical point of view is represented by German scientist Manfred Spitzer (2014). He puts forward the concept of 'digital dementia', believing that online learning or game makes children's knowledge fragmentary, their attention distracted, their patience lacking and their reading and writing abilities declined. Effective learning and the cultivation of deep thinking need to return to the traditional mode [13].

It can be seen that related researches are often based on a specific perspective. However, comprehensive description of cognitive schema has not been finalized.

2.3 Statement of the problem

As an empirical study, it attempts to answer the following questions: 1. What are the profiles of the respondents in terms of age, gender, and major? 2. What are the assessments of the cognitive schema of the respondents in terms of Perception, Attention, Memory, and Thought Processing? 3. Is there a significant difference in the cognitive schema of the respondents when their profiles are taken as test factors? 4. Is there a significant relationship between the four dimensionality of their cognitive schema? 5. What are the observations of the teachers on the respondents' cognitive schema?

2.4 Scope and delimitation of the study

This study references the concept of cognitive schema from Swiss psychologist Piaget's cognitive theory to generalize the pattern. In cognitive psychology, the complete cognitive structure includes perception, attention, memory, memory extraction, knowledge representation, language, thinking and problem solving, reasoning and decision-making [3,5]. This study took it as a basic framework and simplified it as perception, attention, memory, and thinking processing.

Due to the constraints of energy and time, the research area of this subject was limited to Hunan Province, China. The study was conducted in three universities in Hunan Province, China: Hunan University, Hunan University of Arts and Sciences, and Huaihua College, which were chosen because they represent different levels of China's universities.

III. Methodology

This study adopted the mixed research method, quantitative stage was the main body and was checked by the qualitative stage. Student athletes assessed their cognitive schemata using a preliminary Likert scale with 4 options. Afterward, faculty members were invited to conduct in-depth interviews to learn about the students' cognitive characters.

3.1 Sample and sampling technique

In the quantitative study, the selection of samples adopted the combining of random sampling and cluster sampling, which selected students of different majors and different grades in each university. The population of the three universities was 61130, and the selected students' sample was 395. As the complementary research, 17 professional teachers from three universities are invited for the interviews through a combination of convenience sampling and system sampling. They are distributed in 15 different majors, and at the first teaching line.

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3.2 Research instruments

The self-designed Likert scale was based on the definition of cognitive schema, the main indicators were extracted including perception, attention, memory and thinking process. Operational definitions for these four aspects were established and then converted into several related questions with four options. For testing the reliability of the questionnaire, some test questions and some correlation questions were set, and if there were obvious contradictions in the answers, they were marked and dealt with accordingly. For testing the validity of the questionnaire, before the formal use of the questionnaire, a small range of tests had been completed, and the items was modified in combination with the answers. The interview is based on four leading questions of the interview protocol, which is around students' comprehensive performance in class, involving four aspects: perception, attention, memory and thinking.

3.3 Data gathering and treatment

Online Questionnaires were distributed in above mentioned samples. Based on answer-coding, Data-login process collected the answers of each respondent with Excel with missing values marked. In the analysis, the following statistical processing were used by using SPSS: Frequency Count and Percentage, Weighted Mean, T-test /ANOVA, and Pearson correlation coefficient r. The weighted mean was interpreted as Table 1:

Table 1. Scale and description of the weighted mean

Weight	Scale/Range	Description/Interpretation
4	3.51-4.00	Always/ Highly Manifested
3	2.51-3.50	Often/Manifested
2	1.51-2.50	Seldom/Slightly Manifested
1	1.00-1.50	Not at All/Not at All Manifested

There are two null hypotheses in this study. 1. There is no difference in the cognitive schema of the respondents taking age, gender and major as factors. 2. There is no correlation between the cognitive schemata of the respondents with the significance of. If the computed significance value of ANOVA/T test is less than 0.05, the first null hypothesis is rejected. If the computed significance value is less than 0.01, the second null hypothesis is rejected.

IV. Results and Analysis

4.1. Profile of the respondents based on age, gender, and major.

As shown in the answers, 77or 19.5% of the respondents are 18 years old and below, 181 or 45.8% are within 19-20 years old, 121 or 30.6% are within 21-22 years old, and 16 or 4.15% are 23 years old and above, which showed that on the whole the number of college students aged between 19 and 20 was the largest. And 199 or 50.4% of the respondents are male, while 196 or 49.6% are female, which showed that the gender ratio was roughly equal. While 82 or 20.8% of the respondents were from Liberal Arts, 114 or 28.9% were from sciences, 83 or 21% were

in Business major, and 116 or 29.4% were from Engineering, which showed that respondents were mostly from sciences and engineering.

4.2. Assessments on the cognitive schema of the respondents

4.2.1 Assessments on the perception

Table 2. Respondents' assessment of perception

Perception	Mean	Description	Interpretation
Sensitivity to video, audio or pictures	2.85	Often	Manifested
Sensitivity to textual or structure diagrams	2.47	Seldom	Slightly Manifested
Overall perception from the video	2.83	Often	Manifested
Overall perception from text or diagram	2.65	Often	Manifested
Perception with previous experience	2.86	Often	Manifested
Overall perception from pieces of information	2.78	Often	Manifested
Capture others' emotions or body language	2.90	Often	Manifested
Sense of time	2.71	Often	Manifested
Sense of direction	2.62	Often	Manifested
Composite Mean	2.74	Often	Manifested

As shown in Table 2, perception was assessed in nine aspects. The composite result shows that the cognitive schema of the respondents in terms of perception is manifested at 2.74. This goes to show that the respondent has a basic ability to perceive various information stimuli from the outside world, or they can perceive the outside world.

It is manifested among the respondents that they can capture the emotions or body language of others with the highest mean value of 2.90, they can use previous experience to percept with a higher mean of 2.86, they are sensitive to video, audio or pictures stimuli with a mean of 2.85, they can know the whole of an object from a video with a mean value of 2.83, and they can synthesize the overall impression of objects through information pieces with a mean of 2.78. Some items are manifested but don't reach the average. Their sense of time is at a level of 2.71, their perception from description of text is at 2.65, and their sense of direction is at 2.62. On the other hand, seldom that they are sensitive to textual or structure diagram information which gained the lowest mean value of 2.47 interpreted as slightly manifested.
From above, the digital evolution and digital dementia have been proved to some extent. Their high sensitivity to video, audio, and picture stimulation means that the cognitive schema of college students ADAPTS to the digital existence, which can be called digital evolution. On the other hand, they are less sensitive to stimuli such as text or structural information with the lowest average, which supports the view of a decline in traditional reading abilities, which is called digital dementia by the German scientist Manfred Spitzer.

4.2.2 Assessments on the attention

Table 3. Respondents' assessment of attention

Attention	Mean	Description	Interpretation
Be concentrate in a noisy environment	2.36	Seldom	Slightly Manifested
Be focused after start in a work	2.80	Often	Manifested
Attention from video or picture message	2.78	Often	Manifested
Attention from external sounds	2.69	Often	Manifested
Attention from text description	2.56	Often	Manifested
Multitask at the same time	2. 90	Often	Manifested
Watching a football game without scoring a goal	2.11	Seldom	Slightly Manifested
Composite Mean	2.6	Often	Manifested

Attention was assessed in seven aspects, as Table 3. The composite result shows that the cognitive schema of the respondents in terms of attention is manifested at 2.6. This goes to show that the respondent has basic ability to notice various information stimuli from the outside world, or they can pay attention of around things.

It is manifested among the respondents that they can be multitasked with the highest mean value of 2.90, they be focused after start in a work with a high mean value of 2.8, their attention from video messages is with a mean of 2.78, from external sounds is 2.69, and from text description is 2.56. On the other hand, it is slightly manifested in them to concentrate on their business in a noisy environment, and that to watch a football game patiently without scoring a goal with the lowest mean values of 2.36 and 2.11 respectively. The above results suggest that they can be concentrated on objects, which contradicts the arguments of some scholars that they are often distractive. Moreover, the results have shown the proof that they have been adaptable to the Internet era, such as doing several things at the same time, and being sensitive to video information, which maybe imply digital evolution in attention. On the other hand, areas such as environmental influence and lack of patience may be manifestation of digital dementia.

4.2.3 Assessments on the memory

Table 4. Respondents' Assessment of Memory

Memory	Mean	Description	Interpretation
Immediate memory	2.62	Often	Manifested
Long term memory	2.60	Often	Manifested
Memory retrieval when needed	2.60	Often	Manifested
Memory span	2.47	Seldom	Slightly Manifested
Memory depth	2.57	Often	Manifested
Memory of outlines and frames of objects	2.83	Often	Manifested
Memory of theoretical knowledge	2.47	Seldom	Slightly Manifested
Memory of videos or pictures	2.89	Often	Manifested
Memory of operational experience	2.69	Often	Manifested
Composite Mean	2.64	Often	Manifested

Memory was assessed in nine items as Table 4. The composite result shows that the cognitive schema of the respondents in terms of memory is manifested at 2.64. This goes to show that the respondents have basic memory, and to be able to respond to and remember information from the outside world.

As shown in the result, respondents have manifested that their memory of videos or pictures is with the highest mean value of 2.89, memory of outlines and frames of objects is at a mean of 2.83, memory of operational experience is at 2.69, immediately memory is at 2.62, and both long term memory or memory retrieving are at 2.60, and memory depth is at 2.57. On the other hand, their memory span and theoretical memory are at the lowest mean values of 2.47 respectively interpreted as slightly manifested. In terms of memory, the evaluation results imply some points of digital evolution or the adaptability to network survival, such as the capture of video or picture information, outline and instantaneous memory performance, and the tendency to operational contents. While they scored less on depth of the memory which was tested by detailed object and memory span which was measured by random numbers. They scored lowest on theoretical knowledge. All these can be interpreted as a difference or weakening of traditional learning ability based on the dependence of online resources and search engines or external electronic storage.

4.2.4 Assessments on the thought processing

Table 5. Respondents' Assessment of Thought Processing

Thought Processing	Mean	Qualitative Description	Interpretation
Inquiry & questioning	2.79	Often	Manifested

Classification	2.68	Often	Manifested
Generalization & deduction	2.67	Often	Manifested
Contextual & situational thinking	2.77	Often	Manifested
Association & imagining	2.92	Often	Manifested
Relationship building	2.84	Often	Manifested
Quick decision	2.57	Often	Manifested
Application & Promotion	2.61	Often	Manifested
Composite Mean	2.75	Often	Manifested

As Table 5, memory was assessed in eight items. The composite result shows that the cognitive schema of the respondents in terms of thought processing is manifested at 2.73. This goes to show that with the general thinking ability, they can carry on the specific thought processing to the external information or the stimulus.

As shown in the result, it is manifested among the respondents that they are imaginative with the highest mean value of 2.92, they'll ask about the relationship between objects with a mean value of 2.84, they would like to ask why with a mean value of 2.79, they think about the context with a mean value of 2.77, they can categorize problems with a mean value of 2.68, they can generalize or deduce from things with a mean value of 2.67, they can apply or advance what they've learned, and they can make decisions quickly with a mean value of 2.57, which has gained the lowest assessment. All the indicators on the assessment of thought processing are manifested, which show the Net-generation college students' thinking is in a state of active, they reflect from stimulus signal sensitively, such as associating, imagining, inquiry, classifying and generalizing. These results suggest the adaption of the digital surviving of the respondents, and may imply digital evolution to some extent. While it cannot be ignored that the thinking ability related to deep thought processing, namely the ability to generalize, deduce, or make quick judgments or decisions, are lower than other indicators, which may mean that deep thinking ability is weaker than superficial or basic thinking ability. Even if manifested, the items are grounds for caution.

4.2.5 Summary of the respondents' assessment of their cognitive schema

For the cognitive schema of the respondents, the result reveals that student respondents are more sensitive to thought processing as information input which gained the highest assessment from the respondents. Their ability of perception is the second one which is followed by ability of memory, while ability of attention is the lowest one though it is also manifested. In each aspect, some items performed well, which can be understood as showing some degree of adaptation to digital life, some scholars refer to as digital evolution; while others scored less, which may be interpreted as a degree of degeneration, or digital dementia, as some scholars refer to it. This can be explained by the fact that they have become accustomed to online streaming media, multimedia input, and their cognitive schema have changed in some extent. In networked environment and digital survival, the types of information they are interested in, the mode of information reception, reflection, and processing, have changed accordingly.

Classical psychology has many descriptions about the development of cognitive ability of college students in the pre-network era, such as the formation of depth perception, rapid development of concentration, large accumulation of professional knowledge, formation and reinforcement of professional thinking, deep thinking, and systematic thinking. Comparing these abilities, the cognitive schema of Net-generation college students is indeed different from that of traditional college students. Of course, because the delimitation of the study, the discussion of digital evolution or digital dementia is preliminary, and precise assertation need further difference, tendency and correlation analyses.

4.3. Differences in the assessments of cognitive schema based on age, gender, and major

4.3.1 Differences in the cognitive schema based on age

Table 6. Differences in the cognitive schema based on age

Cognitive Shema	Age	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Perception	<=18 y	2.71	0.44	2.44	0.06	Accepted	Not Significant
	19-20 y	2.76	0.40				
	21-22 y	2.75	0.41				
	>=23 y	2.48	0.45				
Attention	<=18 y	2.66	0.45	1.52	0.21	Accepted	Not Significant
	19-20 y	2.61	0.37				
	21-22 y	2.60	0.35				
	>=23 y	2.45	0.41				
Memory	<=18 y	2.67	0.50	1.91	0.13	Accepted	Not Significant
	19-20 y	2.64	0.48				
	21-22 y	2.64	0.40				
	>=23 y	2.38	0.46				
Thought Processing	<=18 y	2.77	0.46	1.79	0.15	Accepted	Not Significant
	19-20 y	2.74	0.42				
	21-22 y	2.77	0.40				
	>=23 y	2.52	0.40				
Over-all	<=18 y	2.71	0.40	2.40	0.07	Accepted	Not Significant
	19-20 y	2.69	0.35				
	21-22 y	2.69	0.32				
	>=23 y	2.46	0.37				

Table 6 shows the differences in the cognitive schema based on age. The result reveals that taking age as a factor there is no significant difference in the assessment of the student respondents as regards their over-all cognitive schema with a significant level of 0.07. And there is no significant difference in the assessment of them in terms of perception, attention, memory and thought processing with a significant level of 0.06, 0.21, 0.13, and 0.15 separately regard of age. This goes to show that they have roughly the same cognitive schema regardless of age. Because they are college students in campus, born around 2000, basically in the stage of 18-23 years old. As mentioned above, they are born in when the popularization of the Internet is about to be completed. Therefore, even the oldest and the youngest have no significant difference in the electronic products and network devices they were exposed to in childhood. It was the children of this age who grown in networked environment, and who are really networked.

Follow-up test showed that, overall, students aged 23 or above get lower score on the assessment of their over-all cognitive schema and the separate aspects than respondents from the three younger age groups. There are no significant internal differences among the three younger age groups. Developmental psychology research has shown that perceptual acuity is high in teens, and memory ability peaks around age 15, after which rote memory declines. The elder respondents enter adulthood, with the growth of experience and the influence of the environment, their basic cognitive abilities may be less sensitive.

4.3.2 Differences in the cognitive schema based on gender

Table 7. Differences in the cognitive schema based on gender

Cognitive Schema	Gender	Mean	SD	Computed t-value	Sig	Decision on Ho	Interpretation
Perception	Male	2.76	0.44	1.77	0.18	Accepted	Not Significant
	Female	2.71	0.39				
Attention	Male	2.68	0.42	6.04	0.02	Rejected	Significant
	Female	2.54	0.33				
Memory	Male	2.70	0.47	1.52	0.22	Accepted	Not Significant

	Female	2.57	0.44				
Thought Processing	Male	2.81	0.45	2.68	0.10	Accepted	Not Significant
	Female	2.69	0.38				
Over-all	Male	2.74	0.38	4.22	0.07	Accepted	Not Significant
	Female	2.63	0.32				

Table 7 shows the differences in the cognitive schema based on age. The result reveals that there are no significant differences in the assessment of the student respondents as regards their over-all cognitive schema regardless of their gender with a significant level of 0.07. This means the cognitive schema are roughly similar regardless of gender. There are no significant differences in the assessment of them in terms of perception, memory, and thought processing regardless of their gender, which means they are similar in the three aspects. On the other hand, the males have shown higher assessment than female ones in terms of attention, which means males are better able to concentrate. Perhaps because females are more attentive and sensitive to their surroundings, their ability to concentrate is a little lower than that of male. While the males are relatively slow to the subtle changes in the outside world, their anti-interference ability is higher than the girls, once involved in something, they can ignore the external interference, maintained attention is relatively strong.

4.3.3 Differences in the cognitive schema based on major

Table 8. Differences in the cognitive schema based on major

Cognitive Shema	Major	Mean	SD	Computed F-value	Sig	Decision on Ho	Interpretation
Perception	Liberal Arts	2.68	0.40	2.68	0.04	Rejected	Significant
	Science	2.67	0.36				
	Business	2.78	0.49				
	Engineering	2.80	0.41				
Attention	Liberal Arts	2.55	0.36	3.57	0.01	Rejected	Significant
	Science	2.54	0.33				
	Business	2.66	0.42				
	Engineering	2.68	0.41				
Memory	Liberal Arts	2.59	0.44	1.67	0.17	Accepted	Not Significant
	Science	2.58	0.38				
	Business	2.68	0.49				
	Engineering	2.69	0.59				
Thought Processing	Liberal Arts	2.68	0.41	3.92	0.01	Rejected	Significant
	Science	2.68	0.39				
	Business	2.81	0.39				
	Engineering	2.82	0.46				
Over-all	Liberal Arts	2.63	0.33	4.06	0.01	Rejected	Significant
	Science	2.62	0.30				
	Business	2.73	0.37				
	Engineering	2.75	0.38				

Table 8 shows the differences in the cognitive schema based on professional type. The result reveals that student respondents have shown significant differences in their assessment as regards their over-all cognitive schema taking their major as a factor. To be specific, there is no significant difference in memory based on major, but there are significant differences in the assessment in terms of perception, attention, and thought processing when their major is taken as test factor. China's National College Entrance Examination is one of the most difficult exams in the world, which needs high school students to go through a lot of memorization and recitation. No matter which majors they are in, their memory ability is relatively good. So, there was no significant difference.

Follow-up test showed there is no significant difference in the assessment of memory, but the respondents from engineering have shown higher assessment in terms of perception, attention, and thought processing than those from others. In addition, business students have also manifested higher than those of science in terms of attention and thought processing, and those of liberal arts students in terms of thought processing. Generally, student respondents from engineering and business manifested higher assessment than those from liberal arts and science. The differences in three aspects of cognitive schema also reflect the reality of Chinese college students, majors on engineering are the most popular in current China, which means those excellent students try to be enrolled in engineering, and majors on business is also favored. It is also possible that the different professional training they underwent after entering college did affect their cognitive schema. Chinese engineering students have many chances for practice such as go to factories or do various projects, these activities may increase their performance in various aspects of cognitive schemata, especially thought process. For students majoring in liberal arts, their practice is not so intuitive and operationalized.

4.4 Relationship between the cognitive schema of the student respondents

Table 9. Correlation between the 4 aspects of cognitive schema

Cognitive Schema	dimension	Computed r	Sig	Decision of Ho	Interpretation
Perception	Attention	0.68	0.00	Rejected	Significant
	Memory	0.57	0.00	Rejected	Significant
	Though Processing	0.60	0.00	Rejected	Significant
	Over-all	0.84	0.00	Rejected	Significant
Attention	Memory	0.63	0.00	Rejected	Significant
	Though Processing	0.60	0.00	Rejected	Significant
	Over-all	0.85	0.00	Rejected	Significant
Memory	Though Processing	0.59	0.00	Rejected	Significant
	Over-all	0.84	0.00	Rejected	Significant
Thought Processing	Over-all	0.82	0.00	Rejected	Significant

As can be seen from Table 9, at the significance level of 0.01, the Pearson correlation coefficients between the four dimensions are all above 0.59, and the Pearson correlation coefficients of over-all cognitive schema are all above 0.82. It means that student respondents' cognitive schema in terms of perception, memory, attention, and thought processing are correlated with each other, and strongly correlated with over-all cognitive schema. Cognitive schema is the basic tendency or habit of people in cognitive activities. It can be understood as a basic framework, based on which the specific tendencies and habits of people's activities emerge. So, they interact with each other, and are highly related.

4.5 Observations of the teachers on the respondents' cognitive schema

In the qualitative stage, 17 professional teachers from three universities in Hunan province were interviewed. There were 17 interviewees, including 9 males, 8 females. There are 3 professors, 5 associate professors, 7 lecturers and 2 assistants.

Overall, according to the responses of the teachers, the results are as follows: students are more sensitive to stimuli such as video, audio and pictures. In terms of attention, interesting video appeal to them, the content of the PPT images, stories, short Flash video can also attract students' attention, and novel points or the point of view that challenge common sense do. In terms of memory, they don't like to remember difficult theories, can remember content fragments or frames, and can remember operation steps. Most students use external storage such as network hard disk and search engines. In the aspect of thought processing, divergent thinking and jumping thinking are obvious, deep thinking is relatively lack or weak. In a sentence, teachers' observation partly reflects the students' cognitive characteristics, which are basically consistent with the results of the quantitative research.

V. Conclusions

Based on the presented results of the study, the following conclusions are emerged: The respondents are mainly within the age bracket of 19-20 years old, male, and from the Sciences and Engineering programs. The assessed extent of cognitive schema of the respondents is found to be manifested in terms of perception, memory, attention and thought processing. The four aspects of assessment show certain group characteristics, which imply digital evolution and digital dementia in some extent. No significant difference exists in the assessed over-all cognitive schema when taking age or gender as a factor, while significant differences exist in the assessed cognitive schema when major type is taken as a test factor. Significant relationship exists between the cognitive schema of the student respondents. According to the teachers, Net-generation college students show unique cognitive characteristics in the classroom.

Therefore, change of teachers' ideas and reforms of teaching mode will help these universities' classes to match students' learning better, to enhance the effectiveness of students' learning, and to develop their professional competence.

VI. Discussions

Treat the cognitive schema of Net-generation college students rationally [1]. For college teachers and administrators, the primary preparation is to rationally view the cognitive schemas of the students, understand that these manifestations are a natural change to adapt to the networked living environment, not criticize them with the inherent traditional standards, and consider teaching activities on the basis of accepting their characteristics.

Reposition the role of college teachers. The assessment results suggest that college students of today are tired of traditional teaching or are not adapted with it. Therefore, for college teachers, they are faced with a difficult challenge, to learn to give up their central authority role, to communication and interaction openly and equally with students, to hand over the classroom to students, and to build a student-centered learning community. And teachers can try to construct new roles, such as the role of guide or companion.

Improve information literacy and use of multimedia technologies. The evaluation results indicate that it is necessary for college administrators and teachers to use multimedia technology and networked equipment, and the level of teachers' IT literacy is related to students' classroom experience and the effect of educational reform. Therefore, it is necessary for teachers to pay attention to the latest technical means, actively participate in technical training, try different networked applications, enrich the experience of information technology, improve self-efficacy, and cope with the challenges of the time with excellent skills and professional ethics.

Guide students to return to traditional paper reading necessarily. A return to traditional paper books reading is still necessary. The assessment has proved that college students welcome multimedia information, and their ability of paper-based reading is relatively weak. However, many professional knowledges cannot be fully video or active, so the traditional paper-based reading is still a necessary way of learning. Paper materials are conducive to focused reading, repeated reflection and in-depth reading, to enlighten wisdom and temper the mind. The step-by-step reading experience presents a sense of location and hierarchy and facilitates long-term memory, which can make up for the shortcomings of rapid reading and fragmented reading.

Cultivate students' ability of information retrieval. It is also necessary to guide students to use the network efficiently and cultivate their ability of information retrieval, extraction and processing. As Yuval Harari writes at his book: 'In ancient times power came from the right to access information; today power comes from what to ignore.' [14] Indeed, as long as 'online,' students are faced with a sea of uneven information, which makes them be easily indulged or lost in. Helping students develop the ability of retrieving and inducing information can reduce the possibility of digital dementia. For colleges and universities, it is also a necessary task to guide students'

balanced development in the aspects of paper book reading and information retrieval ability.

Reform of teachers' teaching methods. The reform designing needs to cater to Net-generation college students' cognitive schema. The teaching mode reforms can be promoted in different way, such as networked teaching, interactive teaching, task-based teaching, and divergent or open teaching. These methods can be used flexibly or in combination according to the specific teaching content and objectives.

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