Mental Image and Representation of Ogive by Students of Diploma in Accountancy in a Mara Institute of Higher Education

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Abstract

The study based on radical constructivism seeks to identify Semester Two Accounting Courses students’ mental images and representations of ogive. Data for this study include verbal and non verbal information gathered from two students of Semester Two Accounting Courses in two clinical interview sessions. This study has identified four properties showed by the mental image of the research participants. In addition, four types of representations used by research participants to describe the ogive were identified. Participants used three methods to identify whether something represents an ogive or not.

1.0 Introduction

Statistics is an important course for most streams at the post-secondary level in MARA higher education institutions. For the Diploma in Accountancy program, statistics is made a compulsory courses as a condition for graduation. Among the objectives of the Diploma in Accountancy program is to produce graduates who are skilled and able to compete with the giants of employment and internationally (Bahagian Pendidikan Tinggi MARA, 2007).

This study is related to statistical learning in post-secondary education. Issues that often arise in statistical learning in post-secondary education relate to student conception of statistics (Carter, 2005; Groth, & Bergner, 2006; Lehrer, Kim, & Schaubble, 2007; Petocz, & Reid, 2005; Saldanha, & Thompson, 2003), the strategies used by students in learning statistics (Gardner, 2007; Lancaster, 2007; Mills, 2004; Nicholas, 2004), and the technology used in the learning of statistics (Kennedy, & McCallister, 2001; Scheaffer, 2000; Schenker, 2007). This study focused on Accounting diploma students’ mental images and representations on ogive.

Mental image and student representation on ogive are important because it is a complex matter that requires detailed analysis and it can improve thinking and learning statistics. Further, the mental image and representation of the ogive cannot be transferred from the thinking of teachers to thinking of students in perfect shape, but the mental image and...
representation of the ogive are constructed by the students on their own experiences.

So far, the current research in statistical learning in the West focused on several aspects such as conception and understanding of students on some specific aspects of statistics (Carter, 2005; Jacobbe, 2007; Leavy, & O'Loughlin, 2006; Meletiou & Lee, 2003; Saldanha & Patrick, 2002; Watson & Moritz, 2000), the strategies used in teaching statistics (Gardener, 2007; Kennedy, & McCallister, 2001), the use of technology in teaching statistics (Schenker, 2007), and the difficulties and mistakes of students in learning statistical concepts (Fishbein, & Schnarch, 1997; Shaughnessy, 1997).

Current studies in statistical learning in Malaysia have focused more on the relationship between attitudes and beliefs towards mathematics and statistics (Leong, 2006) and studies on the relationship between ethnic group, gender, trait self-efficacy and effort with the attainment statistics for the Malay and Chinese undergraduate students (Rosna, 1999).

Although there are many studies in the West and a few in Malaysia on the mental images or representations of students on statistics, none have covered the mental images or representations on ogive. The focus of the studies included the mental images or representations of students of sampling, mean, frequency distribution, standard deviation, probability and histogram; there were no studies on mental image and student representation on the ogive. The mental images of the ogive and the methods used by accounting diploma students to represent the ogive have not been studied in detail.

It is desirable that the study aimed at identifying the mental image and the representation of the ogive of diploma students in MARA Educational Institutions be done. The information obtained from this study will hopefully help teachers, curriculum developers, module writers and administrators of MARA institute of higher education to produce educational statistics products to achieve the aims of statistics education at MARA higher education institutions.

This study is based on radical constructivism and focused on mental images and the representations students’ experiences to build students’ knowledge of the ogive and to give meaning to experience in learning activities on the ogive (Nik Azis, 1999b; von Glasersfeld, 1995).

1.1 Theoretical Background

This study is based on two basic principles (von Glasersfeld, 1995). First, knowledge is actively constructed by the students. Second, the reality owned by an individual is a reality built by himself or herself, and it depends on the quality of action and operational schemes of individuals (von Glaserfeld, 1995).

According to Nik Azis (1987, 1999b) and von Glasersfeld (1995), there are five assumptions in the radical constructivism of learning ogive: the reality of the ogive to each student is an integral part of the construction of their thinking; knowledge of the ogive is constructed for each student based on their experience; knowledge of the ogive is derived from sensory-motor activities and its basic building block is a particular schema; the schema forms mental activity used by students as material for the reflection and abstraction process; and, each intellectual action is built in a progressive manner based on the previous and more primitive cognitive structure.

Based on the above assumptions, for this study, the clinical interview is deemed sufficient to answer the basic questions as described in this study. The clinical interview method consists of observation, questioning and evaluation. This method allows researchers to identify the mental image and representation of the ogive owned by students (von Glasersfeld, 1995).

1.2 Objectives and Research Question
This study aimed at identifying concepts of the ogive held by diploma in accounting students at MARA Institute of Higher Education. Basic questions to be focused in this study are: what is the mental image of the ogive of the Diploma in Accounting students, and what methods are used by students to represent the ogive?

2.0 Methodology

Data for this study were gathered through a clinical interview. The term clinical refers to direct observation of behavior displayed by the participants while they are solving certain problems in the context of one to one (Nik Azis, 1996). Participant behavior observed involved both verbal or non verbal behavior. Clinical interviews enable researchers to identify students’ mental images and representations on ogive from the student’s perspective.

Five research participants for this study, namely Mohd, Shazila, Ali, Nora, and Wati were selected from second semester accounting diploma students. In the course titled introduction to statistics, students are exposed to the topic of statistics during the second semester. Research participants were chosen from the second semester to allow for the scope of the second research question since the ogive is only taught during the second semester.

In this activity, research participants are asked to describe their mental image of the ogive, the words that relate to the ogive, and matters related to the ogive. Participants were asked to give their representation on the ogive, from abstract ideas to concrete forms. Then, the research participants are required to give their explanations why the examples given are representative of the ogive. Further, the research participants are asked to describe non-ogive representation and description of why these are not ogive shapes. Finally, the research participants are given some types of graphs. They are required to determine whether a given graph is a representation of an ogive or not and give an explanation why the graph is a representation of an ogive or not.

3.0 Findings

This section discusses the findings in two parts, namely the mental images held by the research participants and representations used to symbolize the ogive.

3.1 Mental Image

In general, there are four characteristics of mental images owned by the five participants of this study, the linguistic, graphic, figurative, and utilitarian. Linguistic elements involved the use of words, graphics involved the use of the drawn or sketched graph, figurative involved the use of diagrams formed, and utilitarian involved matters of everyday life or current issues related to the ogive.

Mohd mentioned a few words, such as “curve, flexible, change, and the curvature rising and falling” when giving an overview of the word ogive. This mental image is the most dominant.

Next, Mohd drew the ogive as a graph with a smooth curve shaped like the letter S and starting from the origin. According to him, the curve of the ogive in the beginning is the same but can change its shape in the end depend on the x axis and y axis. He added that the ogive is a flexible form of graph, which can curve at any time while other forms of graphs are fixed. According to him, fixed means the shape is rising only or falling only.

Mohd formed a table with two columns for word and set of numbers when asked to illustrate objects associated with the ogive. Next, he described the statistics of matters relating to daily life such as the economy, the currency market, national car sales, social problems, unemployment, the rate of entry of foreign workers, the birth rate, and health.

Shazila said a few words orally, such as an ogive is a “graph with a curve starting from origin, contains the point, the title associated with the labels on both axes, the x axis is represented by the number of pupils, the y axis is represented by the number of jumps”, when asked to provide an overview of the word ogive. She added, “the ogive shape is smooth, slightly bent, not straight, and can be attached to the bottom”. Next, she said “ogive contains a graph, table, cumulative frequency, points, line bent like the letter S, and mode.”
Next, Shazila drew a graph with a curve shaped like the letter \( S \), the \( x \) axis is labeled with the word “number of pupils”, the \( y \) axis with “the number of jumps”, and the title written in the middle of the graph. According to her, the title of the ogive is related to the words labeled on both axes. Apparently, these mental images are the dominant because she always used hand signals shaped like the letter \( S \) and sketched the graph shaped like the letter \( S \) when giving an overview of the ogive.

Shazila drew a diagram in the form of histogram and frequency polygon to reflect the difference between the ogive and other graphs. Next, she formed a cumulative frequency table containing three columns, the number of jumps, and the cumulative frequency when asked to think about things that relate to the ogive. Each column contains a set of numbers.

Ali said verbally that an ogive is a type of graph with \( x \) axis, \( y \) axis, midpoint, and top boundary when asked to give the overview of an ogive. Next, he drew a graph shaped like the suspended letter \( S \) to give a representation of the ogive. It appears that the mental image in the aspect of graphics for the ogive is the dominant form compared to other forms because Ali often showed with hand gestures the \( S \) shape to give an overview of the ogive.

He said a few words such as statistics, mode, and median when asked to give other overview of the ogive. He stated that the frequency and the midpoint were used to form the ogive, and the statistics, the mode and median can be obtained from the ogive. He stated that statistics are related to the ogive. He said statistics as the “mother” and ogive as the “child”, or statistics as the title and ogive as the subtitle. He mentioned the word, “statement” when asked to provide words that describe the ogive because ogive is related to the question in the form of a problem.

Ali formed a frequency table containing a set of numbers to give an image of frequency. According to him, frequency is used to establish the boundaries of the \( y \) axis and the top boundary for the \( x \) axis of the ogive. He distinguished the ogive from other graphs by drawing two graphs, that is, a graph shaped like the letter \( S \) and suspended and a straight line. According to him, the ogive is drawn independently, that is, without a ruler, a collection of points and have the form of rising shape like the letter \( S \).

Ali raised the example of the quiz scores for a group of students, share prices, and frequency when asked to give the impression of things that relate to the ogive. According to him, the graph can be formed based on student quiz scores and stock prices.

Nora mentioned orally that “the ogive has a curve that rises and falls with \( x \) axis is represented by a boundary and the \( y \) axis by the cumulative frequency”. According to her, mean, mode, and the median was associated with an ogive. She added that the ogive is different from histogram and frequency polygon in terms of form and things that represent the \( x \) and \( y \) axis.

In the aspect of graphics, at the initial stage, Nora drew a graph that contains a smooth curve shaped like the letter \( S \) starts with a point on the \( x \) axis with the vertical axis and horizontal axis not labeled with words. Next, she labeled the \( x \) axis with the words, “number of days absent” and the \( y \) axis, “number of workers” and the letter \( F \). She then drew another two curves, which is shaped like the letter \( S \) and the letter \( S \) reversed to explain the meaning of skew and the position of the median.

Nora formed the frequency table, histogram and frequency polygon. The frequency table contains four columns labeled with the word “number of reservations”, “the number of students”, “upper boundary”, and “lower boundary”. The columns were left blank. The histogram consists of four bars attached to the \( x \) axis were labeled with the words, “number of marks”, and the \( y \) axis labeled with the words, “number of students”. Both axis of the frequency polygon were not labeled.

Nora mentioned some things like mean, mode, median, midpoint, quartile and skew. She stated that all items are available from the ogive graph, but the explanation given were related to the definitions and formulas. She drew the ogive skewed to the right and the left to indicate the position of the median. Overall, the dominant mental image of the ogive owned by Nora was in oral form, that was “a form of graphs with increasing and decreasing curvature”.

Wati said orally, “ogive is a graph showing a situation such as the number of hours students study and the number of students.” She added that she was not sure whether the curvature of the ogive was caused by the mode or median. Next, she distinguished the ogive from other graphs through its curve. According to her, “ogive cannot be a straight line and must be curved for the curvature is based on data that has numbers increasing and decreasing.”

Wati then made a sketch that contains an upward curve with the words “number of hours students learn” to represent the $x$ axis and the $y$ axis with the words “number of students” to give an overview of the word ogive. This was the most dominant mental image when recalling the word ogive. According to her, the ogive can also be described in the form of a descending graph because frequency can be arranged in ascending or descending order. She stated that the ogive is formed from data on the matter being investigated and the cumulative frequency.

Wati formed two tables, a frequency table and a frequency table with class interval. The first table had two columns containing “the number of students go for lunch” and “the number of times they go for lunch”. The cumulative frequency table with class interval contained three columns, the column that contains a set of numbers in the form of a class interval, the second column contains a set of numbers for the frequencies, and the third column for the cumulative frequency. She drew a graph in bell shape. According to her, the graph is not an ogive. She added that she thought about the shape of the graph when learning about the ogive. She had no other description of the ogive.

According to her, the cumulative frequency is calculated by adding the frequency with the previous frequency by using the data in the table. The cumulative frequency is used to represent the $y$ axis, while the $x$ axis is represented by the lower boundary and the upper boundary.

Wati stated that two things may be obtained from the ogive, the mode and median. Mode was described by a square attached under the curve on the $x$ axis, with the highest score in the middle of the square taken as the mode. According to her, the median is the midpoint of the ogive, but she was not really sure how to obtain it.

Table 1  
Representations of the Ogive

<table>
<thead>
<tr>
<th>Participant</th>
<th>Symbol</th>
<th>Graph</th>
<th>Table form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mohd</td>
<td>None</td>
<td>Graph shaped like the letter $S$. The curve begins from the origin, the $x$ axis is labeled with the letter $x$ and the $y$ axis with the letter $y$</td>
<td>None</td>
</tr>
<tr>
<td>Shazila</td>
<td>Did not write the symbol, but always used hand gestures shaped like the letter $S$</td>
<td>Graph shaped like the letter $S$. The curve begins from the origin, the $x$ axis is labeled with the letter $x$ and the $y$ axis with the letter $y$.</td>
<td>Frequency table. Frequency table containing class interval.</td>
</tr>
<tr>
<td>Ali</td>
<td>None</td>
<td>Graph shaped like the letter $S$. The curve begins from the origin, the $x$ axis is labeled with the letter $x$ and the $y$ axis with the letter $y$.</td>
<td>None</td>
</tr>
<tr>
<td>Nora</td>
<td>None</td>
<td>Graph shaped like the letter $S$. The curve begins from the origin, the $x$ axis is labeled with the letter $x$, and the $y$ axis with the letter $y$. Graph shaped like an inverted letter $S$. Graph with bell shape.</td>
<td>None</td>
</tr>
<tr>
<td>Wati</td>
<td>None</td>
<td>Graph shaped like the letter $S$. The curve starts from the origin, the $x$ axis</td>
<td>Frequency table containing class interval.</td>
</tr>
</tbody>
</table>
is labeled with the letter $x$, and the $y$
axis with the letter $y$.

3.2 Representation

This section discusses the representation used by the five participants of the study to illustrate the ogive. There are four types of representations by Mohd, Shazila, Ali, Nora, and Wati. The four types of representation can be divided into three general categories, namely symbols, images, and tables. Table 1 displays the summary of the types of representations used by the five participants of the study.

Only Shazila used the type of representation in the category of symbols representing the letters $S$. She did not write this symbol, but always used hand gestures shaped like the letter $S$ when asked to give representation of an ogive.

Type of representation in the category of images involving the use of graphs. In representations of the graph, three types of graphs were used to represent the ogive. The first type of graph used to represent the ogive was a graph shaped like the letter $S$. For this representation, the graph curve start from the origin, $x$ axis is labeled with the letter $x$, and $y$ axis with the letter $y$. This graph was the dominant representation compared to other types of representation for all the five research participants had used this type of representation. The second type of graph used to represent the ogive is a graph shaped like the inverted letter $S$. Only Nora used this type of representation. The third type of graph used to represent the ogive was a graph shaped like a bell, and Nora is the only participant who used this type of representation to represent the ogive.

The last category of representations of an ogive involved the use of tables. In representations of the table form, two tables were used, a frequency table and a frequency table containing class intervals. The frequency table contained three columns written in letters $x$, $f$, and $F$. The three columns contained a set of numbers. Shazila and Wati used this type of representations.

The frequency table containing class intervals were of two types: the frequency table with four columns, written with letters and words, that $x$, $f$, $F$, and upper boundary. Only Shazila used this type of representation. The frequency table that contains class intervals of the second type is a table that contains a set of numbers called the frequency and class intervals that contains the lower limit and upper limit. Wati was the only one who used this type of representation.

This study also identified representations on non-ogive shapes used by the participants of the study. Research participants tended to use images that involve graphs and diagrams that they learned in statistics. Non-ogive shapes representation used in the form of a graph were the frequency polygon, straight line, graph of the normal distribution, normal distribution graph skewed to the left, and normal distribution graph skewed to the right. Four research participants used a frequency polygon, namely Mohd, Shazila, Ali, and Nora. Only Mohd used a representation of a non-ogive shape in the form of a straight line. Only Nora used a non-ogive representation in the form of a normal distribution graph, normal distribution graph skewed to the left, and normal distribution graph skewed to the right.

Non-ogive shapes in the form of diagrams were histograms, bar charts and pie charts. All five participants of the study used the histogram, only Mohd used bar charts and pie charts. Representations of non-ogive shapes in the form of figures were cones, cylinders, and circles. Only Mohd used cone and cylinder. Only Wati used the circle.

Another finding of this study is the method used by research participants to identify whether something is the representation of an ogive or not. According to Mohd, representation of the ogive is a graph that contains two axes, a set of points, the arch-shaped flexible curves, starting from the origin, and are not closed. According to him, the top border derived from the marks can be used to represent the $x$ axis and the title containing the words, “ogive” is given by the graph.
Shazila used three methods to determine whether it was a representative of an ogive or not. First, representation of the ogive is a graph that contains a set of points that start from the origin, a smooth curve shaped like the letter S and is not closed. Second, the x axis is represented by a boundary and the y axis is represented by the cumulative frequency.

Ali used three ways to identify whether something is representative of an ogive or not. First, the graph is shaped like the letter S beginning from the origin, the x axis is represented by the upper boundary, and y axis is represented by the cumulative frequency. Second, all points are connected freely without using a ruler. Third, the ever-upward curve is not closed, and the end point does not touch the x axis.

Nora used three ways to determine whether something is representative of an ogive or not. First, the ogive has a mild form of a dent as all points are connected independently, that is, without using a ruler. Second, items representing the x axis and y axis. According to her, the y axis of the ogive is represented by the cumulative frequency, while x axis is represented by the top boundary.

Wati used one method to identify whether something is representative of an ogive or not. She stated that it is representative of an ogive if the y axis is represented by the cumulative frequency and the x axis is represented by the bottom border and the top border.

4.0 Summary

The focus of this section is to discuss the findings about mental images and representations formed by the participants of the study and the implications of this research to teaching.

4.1 Mental Image

Mental image refers to the image formed by a person in his mind about something that is spontaneously associated when a particular word is pronounced upon him. In this study, participants were requested to form a mental image of the word ogive, the words that relate to the ogive, and the matter or thing relating to the ogive.

Mental images shown by the five participants of this study consisted of four features, namely linguistic, graphic, figurative, and utilitarian. Mohd, Ali, Nora, and Wati only have mental image in terms of utility. Mental images in terms of graphics were the most dominant because the mental images of all five participants of the study had these features.

From the aspect of linguistics, the research participants described an ogive as a graph with a curve, flexible, changing, bent, with the x axis, y axis, the central point, a top border, a curve that is rising and falling with the x axis represented by the top boundary and y axis by the cumulative frequency, and a graph showing a situation such as “the number of hours students study” and “the number of students”.

Here was a common mental image from the linguistic aspect and graphical aspect, where the ogive was pictured as a graph with a smooth curve starting from the origin and shaped like the letter S. However, there was also a mental image in terms of graphics, where the ogive is described as a graph with a smooth curve shaped like the inverted letter S. Mental images in both these aspects involved the product, in the form of an ogive graph.

From the figurative aspect, the research participants created two types of tables, one table containing two columns and a cumulative frequency table containing three columns. Mental image of this aspect involved two things, namely the basic objects and processes that need to be done to the basic objects to produce a graph of the ogive. In the aspect of utility, a mental image of the research participants involved the use or contribution of mathematics in daily life.

4.2 Representation

There are six types of representation used by the five participants of this study to represent the ogive, the symbol S, the graph shaped like the letter S started from the origin, the graph shaped like a reversed letter S, the graph shaped
like a bell, and two tables, a frequency table and a frequency table with class intervals.

Research participants tended to use two concrete objects to represent non-ogive shapes, namely graphics and figuratives. In the graphical aspect, the research participants used a frequency polygon, straight line, normal distribution curve, normal distribution curve skewed to the left, and normal distribution curve skewed to the right. In the figurative aspects, the study participants used pie chart, histogram, bar chart, cylinder, cone, and circle.

Three ways were used by research participants to identify whether an object is representative of an ogive or not. First, an ogive is a curve with a set of connected points and shaped like the letter S starts from the origin. Second, the ogive curve is not closed; the end point does not touch the x axis. Third, the data are given in the form of a table containing two items used to represent the two axes, with the top border to represent the x axis and cumulative frequency to represent the y axis.

5.0 Conclusion

As a result of interaction with the participants of this study, I found that the mental images and representations of the ogive to each student is an integral part of the construction of their thinking: knowledge of the ogive is constructed for each student based on his or her experience; knowledge of the ogive is derived from sensory-motor activities and its basic building block is a particular schema; the schema forms mental activity used by students as material for the reflection and abstraction process; and, each intellectual action is built in a progressive manner based on the previous and more primitive cognitive structure.

References


