CHAPTER IV

INVESTIGATION OF E-TUTORING IN COMPUTER GRAPHICS

4.1 INTRODUCTION

Instructional objectives of e-Tutoring can be determined analytically through quantification of Cognitive structures in every parts of the e-content, particularly in the Instructional materials. The quantified values can then be researched upon (Lianghao Fan (2004)). Content analyses would be performed on selected instructional parts (chapter III). Content analytical results would yield important inferences for the proposal of any instructional model (chapter II). This chapter elaborates the content analysis carried out on certain selected Sections of the e-Contents of “Computer Graphics’ of NPTEL. The content analytical procedure is explained in Chapter III. The objective of this exercise is to determine the context on the effectiveness of Instructions in the selected contents of e-Tutoring (chapter I). The selected e-contents would not have been designed using First Principles of Instruction; however, quantifying the cognitive structures would help in determining the extent in which the content should be designed for effective instructions using the existing Merrill’s (2002) model known as ‘First Principles of Instruction’. Besides, quantification would help in designing the proposed e-instructional approach by the researcher. Accordingly, the content analysis is done.
Section 4.2 outlines the content analytical results of the chosen e-contents of ‘Computer Graphics’ of NPTEL. Important and useful inferences derived from these content analyses are brought out in Section 4.3.

4.2 CONTENT ANALYTICAL STUDY

As quested earlier and also found from earlier literature studied and reported, most of the content study results obtained from textual materials of similar subjects are mostly represented by ‘Demonstration’ cognitive structure. Further to this observation, it is also found that most of these materials are informative and not exactly demonstrative in nature. According to Merrill (2007), the cognitive portrayal ‘Demonstration’ needs to be demonstrative and not informative. However, as the textual materials are descriptive but informative in nature, they have been grouped under the category ‘Demonstration’. Chapter III elaborated the technique adapted for content study. Accordingly the analysis performed and results obtained are briefed below. Results are structured according to chapter/section of the e-contents of the subject ‘Computer Graphics’ of NPTEL. The study has been carried out so as to segregate the textual material into two types namely i) Informative and ii) Instructive – that is demonstrative as per Merrill’s definition. In view of the above, the results are segregated appropriately and presented accordingly. Sample content of NPTEL presented in Appendix IV.

4.2.1 Section I Introduction

This Section is divided into three parts, namely, i. ‘Computer Graphics’, ii. Graphical User Interface and iii. Computer Graphics Systems. The acronym RWP used in the exhibits represents ‘Real World Problem’, as per the definition of ‘First Principles of Instruction’. Results obtained from each part are presented along with observation. Total number of parts in this Section is 3 and total number of slides available is 15.
4.2.1.1 Part 1 Computer Graphics

Total number of Slides: 4

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures](image)

Figure 4.1 Distribution of Informative Cognitive Structures on Computer Graphics

Distribution of Instructive Cognitive Structures:

![Diagram showing distribution of instructive cognitive structures](image)

Figure 4.2 Distribution of Instructive Cognitive Structures on Computer Graphics
Observation

In the ‘Introduction’ part of the e-content of Section I, 82% (Figure 4.1) of the material is informative while the rest (18%) is actually (Figure 4.2) instructive (or demonstrative). The maximum represented cognitive structure of the ‘informative’ portion of the material is ‘Application’ (46%) followed equally by ‘Activation’ and ‘Demonstration’ (18% each). There is no ‘Integration’ portrayal at all. Whereas, the entire (18% of the) instructive material is found to be demonstrative (‘Demonstration’ portrayal) in nature. This part therefore does not promote effective learning.

4.2.1.2 Part 2 Graphical User Interface

Total number of Slides: 6

Distribution of Informative Cognitive Structures

![Diagram showing the distribution of informative cognitive structures on Graphical User Interface]

Figure 4.3 Distribution of Informative Cognitive Structures on Graphical User Interface
Distribution of Instructive Cognitive Structures

 Observation

 100% of the Graphical User Interface material of the e-content is purely informative and not instructive (or demonstrative) in nature. The maximum represented cognitive structure of the ‘informative’ portion of the material is ‘Demonstration’ (36%) (Figure 4.3) followed by ‘Activation’ (28%) while the rest are 18% (Figure 4.3) each of ‘Application’ and ‘Integration’. Even though all the four cognitive structures are present, the entire part is informative and not instructive. This part also therefore does not promote effective learning.
4.2.1.3 Part 3 Computer Graphics Systems

Total number of Slides: 5

Distribution of Informative Cognitive Structures

![Diagram](image1.png)

Figure 4.5 Distribution of Informative Cognitive Structures on Computer Graphics Systems

Distribution of Instructive Cognitive Structures

![Diagram](image2.png)

Figure 4.6 Distribution of Instructive Cognitive Structures on Computer Graphics Systems
Observation

The e-content of ‘Computer Graphics System’ is once again found to be more informative rather instructive (or demonstrative) in nature. The maximum represented cognitive structure of the ‘informative’ portion of the material is ‘Demonstration’ (75%) (Figure 4.5) followed by ‘Application’ (8%) while the rest of 17% is ‘Integration’ (Figure 4.6) but demonstrative in nature. But for activation, this part to a little extent would promote learning, according to the First Principles of Instruction.

4.2.1.4 Overall Cognitive Structures in Section I ‘Introduction’

The overall presence of cognitive structures in Section I is briefed along with facts and examples as existing in actual slide.

Example(s)

1. On ‘Demonstration’

“Computer Graphics involves display, manipulation and storage of pictures and experimental data for proper visualization using a computer.

Typical graphics system comprises of a host computer with support of fast processor, large memory, frame buffer ….”

2. On ‘Application’

“Typical applications areas are ….

- Plotting in science and technology
- Web/business/commercial publishing and advertisements
- CAD/CAM design (VLSI, Construction, Circuits)
- Scientific Visualization”
The summary of data pertaining to cognitive structures of instruction is presented in Table 4.1.

Table 4.1 Cognitive Structures in Section I on ‘Introduction to CG’

<table>
<thead>
<tr>
<th>Part No.</th>
<th>No. of Slides</th>
<th>Title</th>
<th>Informative</th>
<th>Instructive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>D</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>Introduction to CG</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>GUI</td>
<td>28%</td>
<td>36%</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>CG Systems</td>
<td>-</td>
<td>75%</td>
</tr>
</tbody>
</table>

The overall presence in the entire Section is summed up and presented.

Distribution among Informative Contents

- Activation: 17%
- Demonstration: 49%
- Application: 24%
- Integration: 10%

Distribution among Instructive Contents

- Activation: 0%
- Demonstration: 51%
- Application: 0%
- Integration: 49%

Overall informative representation: 88%
Overall instructive representation: 12%
**Observation**

It is clearly demonstrated that the slide presentations are treated in two instructional styles, namely:

i) **Informative.**

Concepts are merely presented with ‘What is What’ as only information and not describing as ‘Why and/or How’ on the conceptual basis.

ii) **Instructive**

Concepts are instructed as ‘What, How, Why and Where’ basis. This kind of instruction is called ‘Demonstration’ according to the First Principles of Instruction (Merrill – 2007).

Accordingly the slide presentations are grouped into the above two categories. It is evidenced from the content analytical results on this Section, that the ‘Informative’ presence is much higher (88:12) than ‘Instructive’ style in this Section I on ‘Introduction of Computer Graphics’. It is observed from the three parts that the ‘Demonstration’ cognitive structure is the predominant portrayal in both the cases. It is also observed that the slides with pictures/diagrams are more instructive rather than informative unlike the slides with textual information.

**4.2.2 Section II Display Devices**

This Section is divided into 12 parts. The titles of these parts along with other data are presented in sub sections (that follow) and also in Table 4.2. The acronym RWP used in the exhibits represents ‘Real World Problem’, as per the definition of ‘First Principles of Instruction’. Results obtained from each part are presented along with observation. Total number of parts in this Section is 12 and total number of slides available is 74.
4.2.2.1 Part 1 Cathode Ray Tubes (CRTs)

Total number of Slides: 3

Distribution of Informative Cognitive Structures

Figure 4.7 Distribution of Informative Cognitive Structures on Cathode Ray Tubes

Distribution of Instructive Cognitive Structures

Figure 4.8 Distribution of Instructive Cognitive Structures on Cathode Ray Tubes
**Observation**

In this part of the e-content of Section II, 80% of the material is informative while the rest (20%) is actually instructive (or demonstrative). The maximum represented cognitive structure of both the cases is ‘Demonstration’ (40% in the case of ‘Informative’ while 20% in ‘Instructive’). There is no ‘Integration’ nor ‘Activation’ portrayal at all. This part therefore does not promote effective learning, as recalling prior knowledge is missing.

**4.2.2.2 Part 2 Operations of CRTs**

Total number of Slides: 3

**Distribution of Informative Cognitive Structures**

![Diagram showing distribution of cognitive structures](image)

**Figure 4.9 Distribution of Informative Cognitive Structures on Operations of CRTs**
Distribution of Instructive Cognitive Structures

![Diagram showing distribution of cognitive structures: Integration 0%, Activation 0%, Application 0%, Demonstration 100%.]

**Figure 4.10 Distribution of Instructive Cognitive Structures on Operations of CRTs**

**Observation**

In this part of the e-content of Section II, no material is found to be informative when the entire content is actually instructive (or demonstrative). The maximum represented cognitive structure in instructive part is pure ‘Demonstration’ with 100% (Figure 4.10). There is no other portrayal is found to be present. This part may arguably be treated effective but for the title itself which needs to be activated from the learners.
4.2.2.3  Part 3 DVST

Total number of Slides: 1

Distribution of Informative Cognitive Structures:

Figure 4.11 Distribution of Informative Cognitive Structures on DVST

Distribution of Instructive Cognitive Structures:

Figure 4.12 Distribution of Instructive Cognitive Structures on DVST
**Observation**

In this part of the e-content of Section II, no material is found to be instructive when the entire content is actually informative unlike the earlier part. The maximum represented cognitive structure in informative part is pure ‘Integration’ with 100% (Figure 4.11). There is no other portrayal is found to be present. This part may be treated effective only for higher level learner characteristics and cannot be for lower level learner characteristics.

### 4.2.2.4 Part 4 Scan SDS

Total number of Slides: 8

**Distribution of Informative Cognitive Structures**

![Diagram showing distribution of cognitive structures]

**Figure 4.13 Distribution of Informative Cognitive Structures on Scan SDS**
Distribution of Instructive Cognitive Structures

In Part 4 of Section II, no ‘Application’ or ‘Activation’ is found to be present. The maximum represented cognitive structure in both the cases is ‘Demonstration’. ‘Integration’ is equally present in both the cases with 10% each. It may be agreeable for this Part, as the content is more descriptive and hence has to be demonstrative. However, the presence of ‘Integration’ with 10% may be treated well.
4.2.2.5 Part 5 Raster SDS

Total number of Slides: 6

Distribution of Informative Cognitive Structures

![Figure 4.15 Distribution of Informative Cognitive Structures on Raster SDS](image)

 Distribution of Instructive Cognitive Structures

![Figure 4.16 Distribution of Instructive Cognitive Structures on Raster SDS](image)
Observation

In Part 5 of this Section II, neither ‘Application’ nor ‘Integration’ is found to be present. The maximum represented cognitive structure in both the cases is once again ‘Demonstration’. It is worth noting the large presence of ‘Demonstration’ (66%) (Figure 4.16) in the instructive portion. ‘Activation’ is present with 17% only in the instructive portion.

4.2.2.6 Part 6 Scan Conversion

Total number of Slides: 18

Distribution of Informative Cognitive Structures

![Diagram showing distribution of cognitive structures]

Figure 4.17 Distribution of Informative Cognitive Structures on Scan Conversion
Distribution of Instructive Cognitive Structures

![Distribution of Instructive Cognitive Structures](image)

**Figure 4.18** Distribution of Instructive Cognitive Structures on Scan Conversion

**Observation**

In this part, it is observed that there is no presence of ‘Activation’ in both the cases as seen in most of the cases. However, the distribution of cognitive structures are seems to be acceptable in both the cases, as a little bit of demonstration is found in informative portion, while it is substantiate in instructive portion.
4.2.2.7 Part 7 Display Standards

Total number of Slides: 3

Distribution of Informative Cognitive Structures

![Informative Cognitive Structures Diagram]

Figure 4.18 Distribution of Informative Cognitive Structures on Display Standards

Distribution of Instructive Cognitive Structures

![Instructive Cognitive Structures Diagram]

Figure 4.19 Distribution of Instructive Cognitive Structures on Display Standards
Observation

In Part 7 of Section II, it is observed that 72% (Figure 4.18) of presence in informative portion is ‘Activation’ which is unusual comparing with other parts and sections. While the rest of cognitive structures are not to be found in this portion, only 28% of ‘Demonstration’ (Figure 4.19) is found in instructive portion, while no other portrayal is found. As per nature of instructing any standard, this can be perfectly accepted.

4.2.2.8 Part 8 Frame Buffer

Total number of Slides: 5

Distribution of Informative Cognitive Structures

![Diagram showing the distribution of informative cognitive structures on Frame Buffer with Integration 44%, Activation 0%, Application 0%, and Demonstration 0%.]

Figure 4.20 Distribution of Informative Cognitive Structures on Frame Buffer
Distribution of Instructive Cognitive Structures

![Diagram showing distribution of cognitive structures](image)

**Figure 4.21  Distribution of Instructive Cognitive Structures on Frame Buffer**

**Observation**

Similar to the previous part, instead of ‘Activation’, the presence of cognitive structure in informative portion is only ‘Integration’. Similar to the previous part, there is only ‘Demonstration’ found in instructive portion. ‘Frame buffer’ requires ‘Application’ and ‘Activation’ for effective instruction.
4.2.2.9 Part 9 Operations of CRT

Total number of Slides: 8

Distribution of Informative Cognitive Structures

Figure 4.22 Distribution of Informative Cognitive Structures on CRT

Distribution of Instructive Cognitive Structures

Figure 4.23 Distribution of Instructive Cognitive Structures on CRT
Observation

But for the absence of ‘Activation’ in both the cases, the distribution may be somewhat accepted for this part ‘Operations of CRT’. By nature, the content of this part needs to be more demonstrative, and that is what observed. A reasonable presence of ‘Integration’ is also good.

4.2.2.10 Part 10 Gray Levels and Bits

Total number of Slides: 6

Distribution of Informative Cognitive Structures

![Diagram showing distribution of cognitive structures]

Figure 4.24 Distribution of Informative Cognitive Structures on Gray Levels and Bits
Distribution of Instructive Cognitive Structures

![Diagram showing distribution of in instructive cognitive structures]

Figure 4.25  Distribution of Instructive Cognitive Structures on Gray Levels and Bits

**Observation**

A basic material content such as ‘Gray levels and Bits’ certainly require ‘Activation’ and worked out examples (‘Application’), while both of them are found to be missing in both the cases. Even though substantial portion of ‘Integration’ is found in both the cases, because of the total absence of ‘Activation’ and ‘Application’, this part cannot be effective in instruction at all.
4.2.2.11 Part 11 LCD

Total number of Slides: 3

Distribution of Informative Cognitive Structures

Figure 4.26 Distribution of Informative Cognitive Structures on LCD

Distribution of Instructive Cognitive Structures

Figure 4.27 Distribution of Instructive Cognitive Structures on LCD
Observation

A typical ineffective instructive material this is. There is absolutely no cognitive structure in the instructive portion, while 100% (Figure 4.26) of the cognitive structure in informative portion is found to be ‘Demonstration’. Even though ‘LCD’ is demonstrative in nature, instruction on it cannot be effective only with pure information about it.

4.2.2.12 Part 12 Types of Display Devices

Total number of Slides: 10

Distribution of Informative Cognitive Structures
Distribution of Instructive Cognitive Structures

Figure 4.29  Distribution of Instructive Cognitive Structures on Types of Display Devices

Observation

It is once again observed to be demonstrative instruction of this part cannot be effective, as other cognitive structures are scanty.

4.2.2.13 Overall Cognitive Structures in Section II ‘Display Devices’

The overall presence of cognitive structures in Section II is briefed along with facts and examples as existing in actual slide.

Example(s)

i) On ‘Demonstration’

“Scan Conversion involves display, manipulation and storage of pictures and experimental data for proper visualization using a computer.”
Typical graphics system comprises of a host computer with support of fast processor, large memory, frame buffer ….”

ii) On ‘Application’

“Typical applications areas are ….

The summary of data pertaining to cognitive structures of instruction is presented in Table 4.2.

Table 4.2 Cognitive Structures in Section II on ‘Display Devices’

<table>
<thead>
<tr>
<th>Part No.</th>
<th>No. of Slides</th>
<th>Title</th>
<th>Informative</th>
<th>Instructive</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td>A</td>
<td>D</td>
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<tr>
<td>1</td>
<td>3</td>
<td>CRTs</td>
<td>-</td>
<td>40%</td>
</tr>
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<td>2</td>
<td>3</td>
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<td>-</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>DVST</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>Random SDS</td>
<td>-</td>
<td>43%</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Raster SDS</td>
<td>-</td>
<td>17%</td>
</tr>
<tr>
<td>6</td>
<td>18</td>
<td>Scan Conversion</td>
<td>-</td>
<td>7%</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>Display Standards</td>
<td>72%</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>Frame Buffer</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>Operations of CRT</td>
<td>-</td>
<td>25%</td>
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<td>10</td>
<td>6</td>
<td>Gray levels and BITs</td>
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<td>-</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
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<td>-</td>
<td>100%</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>Types of Display Devices</td>
<td>-</td>
<td>75%</td>
</tr>
</tbody>
</table>

The overall presence in the entire Section is summed up and presented.

Distribution among Informative Contents

Activation : 11%
Demonstration : 47%
Application : 9%
Integration : 33%
Distribution among Instructive Contents

- Activation: 3%
- Demonstration: 80%
- Application: 7%
- Integration: 10%

Overall informative representation: 54%
Overall instructive representation: 46%

Observation

It is clearly demonstrated that the slide presentations are treated in two instructional styles, namely:

iii) Informative

Concepts are merely presented with ‘What is What’ as only information and not describing as ‘Why and/or How’ on the conceptual basis.

iv) Instructive

Concepts are instructed as ‘What, How, Why and Where’ basis. This kind of instruction is called ‘Demonstration’ according to the First Principles of Instruction (Merrill – 2007).

Accordingly the slide presentations are grouped into the above two categories. It is evidenced from the content analytical results on this Section, that the ‘Informative’ presence is much higher (88:12) than ‘Instructive’ style in this Section II on ‘Display Devices’. It is observed from the three parts that the ‘Demonstration’ cognitive structure is the predominant portrayal in both
the cases. It is also observed that the slides with pictures/diagrams are more instructive rather than informative unlike the slides with textual information.

4.2.3 Section III 2D Transformations

This Section is divided into 12 parts. The titles of these parts along with other data are presented in sub sections (that follow) and also in Table 4.3. The acronym RWP used in the exhibits to follow also like other cases represents ‘Real World Problem’, as per the definition of ‘First Principles of Instruction’. Results obtained from each part are presented along with observation. Total number of parts in this Section is 12 and total number of slides available is 12.

4.2.3.1 Part 1 Matrix Representations

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Distribution of Informative Cognitive Structures](image)

Figure 4.30 Distribution of Informative Cognitive Structures on Matrix Representation
Distribution of Instructive Cognitive Structures

![Distribution of Instructive Cognitive Structures on Matrix Representation](image)

**Figure 4.31** Distribution of Instructive Cognitive Structures on Matrix Representation

**Observation**

Even this single slide is found to be purely demonstrative in nature. As per FPI, even a single slide could represent all portrayals. Matrix representations can well be asked with a few questions (‘Application’). A similar observation is found to be in all the remaining 6 parts (slides).
4.2.3.2 Part 2 Transformation

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Diagram showing the distribution of informative cognitive structures on transformation]

Figure 4.32 Distribution of Informative Cognitive Structures on Transformation

Distribution of Instructive Cognitive Structures

![Diagram showing the distribution of instructive cognitive structures on transformation]

Figure 4.33 Distribution of Instructive Cognitive Structures on Transformation
4.2.3.3 Part 3 Shearing

Total number of Slides: 1

Distribution of Informative Cognitive Structures

Figure 4.34 Distribution of Informative Cognitive Structures on Shearing

Distribution of Instructive Cognitive Structures

Figure 4.35 Distribution of Instructive Cognitive Structures on Shearing
4.2.3.4 Part 4 Rotation

Total number of Slides: 1

Distribution of Informative Cognitive Structures

Figure 4.36 Distribution of Informative Cognitive Structures on Rotation

Distribution of Instructive Cognitive Structures

Figure 4.37 Distribution of Instructive Cognitive Structures on Rotation
4.2.3.5 Part 5 Translation

Total number of Slides: 1

Distribution of Informative Cognitive Structures

Figure 4.38 Distribution of Informative Cognitive Structures on Translation

Distribution of Instructive Cognitive Structures

Figure 4.39 Distribution of Instructive Cognitive Structures on Translation
4.2.3.6 Part 6 Homogeneous Coordinates

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures on homogeneous coordinates]

Figure 4.40 Distribution of Informative Cognitive Structures on Homogeneous Coordinates

Distribution of Instructive Cognitive Structures

![Diagram showing distribution of instructive cognitive structures on homogeneous coordinates]

Figure 4.41 Distribution of Instructive Cognitive Structures on Homogeneous Coordinates
4.2.3.7 Part 7 Composite Transformations

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures](image)

**Figure 4.42** Distribution of Informative Cognitive Structures on Composite Transformations

Distribution of Instructive Cognitive Structures

![Diagram showing distribution of instructive cognitive structures](image)

**Figure 4.43** Distribution of Instructive Cognitive Structures on Composite Transformations
4.2.3.8  Part 8 Arbitrary Rotation

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Distribution of Informative Cognitive Structures on Arbitrary Rotation](image1)

Figure 4.44 Distribution of Informative Cognitive Structures on Arbitrary Rotation

Distribution of Instructive Cognitive Structures

![Distribution of Instructive Cognitive Structures on Arbitrary Rotation](image2)

Figure 4.45 Distribution of Instructive Cognitive Structures on Arbitrary Rotation
4.2.3.9  Part 9 Arbitrary Scaling

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures.](image1)

**Figure 4.46** Distribution of Informative Cognitive Structures on Arbitrary Scaling

Distribution of Instructive Cognitive Structures

![Diagram showing distribution of instructive cognitive structures.](image2)

**Figure 4.47** Distribution of Instructive Cognitive Structures on Arbitrary Scaling
4.2.3.10 Part 10 Commutative Transformation

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures]

Figure 4.48 Distribution of Informative Cognitive Structures on Commutative Transformation

Distribution of Instructive Cognitive Structures

![Diagram showing distribution of instructive cognitive structures]

Figure 4.49 Distribution of Instructive Cognitive Structures on Commutative Transformation
4.2.3.11 Part 11 Coordinate System

Total number of Slides: 1

Distribution of Informative Cognitive Structures

Figure 4.50 Distribution of Informative Cognitive Structures on Coordinate System

Distribution of Instructive Cognitive Structures

Figure 4.51 Distribution of Instructive Cognitive Structures on Coordinate System
4.2.3.12 Part 12 Windows to Viewports

Total number of Slides: 1

Distribution of Informative Cognitive Structures

Figure 4.52 Distribution of Informative Cognitive Structures on Windows to Viewport

Distribution of Instructive Cognitive Structures

Figure 4.53 Distribution of Instructive Cognitive Structures on Windows to Viewport
4.2.3.13 Overall Cognitive Structures in Section III ‘2D Transformations’

The overall presence of cognitive structures in Section III is briefed along with facts and examples as existing in actual slide.

Example(s):

1. On ‘Demonstration’

“Coordinate Systems involves Screen Coordinates, World coordinates, Window and Viewport. Screen Coordinates used to address the screen. World coordinates used to specify coordinates having its own units of measure, axis, origin, etc. Rectangle region of the world that is visible is called as Window. The rectangle region of the screen space that is used to display window is called as Viewport”.

2. On ‘Application’

“Typical applications areas are ….

The summary of data pertaining to cognitive structures of instruction is presented in Table 4.3.
Table 4.3 Cognitive Structures in Section III on ‘3D Transformations’

<table>
<thead>
<tr>
<th>Part No.</th>
<th>No. of Slides</th>
<th>Title</th>
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<th>Instructive</th>
</tr>
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<td></td>
<td></td>
<td>A  D  Ap  I</td>
<td>A  D  Ap  I</td>
</tr>
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<td>1</td>
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<td>-  -  -  -</td>
<td>100% - -</td>
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</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Shearing</td>
<td>-  -  -  -</td>
<td>100% - -</td>
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<td>100% - -</td>
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<td>100% - -</td>
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<td>100% - -</td>
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<tr>
<td>10</td>
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<td>-  -  -  -</td>
<td>50% 50%</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>Coordinate System</td>
<td>100% - -</td>
<td>- - - -</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>Windows to Viewport</td>
<td>-  -  -  -</td>
<td>100% - -</td>
</tr>
</tbody>
</table>

The overall presence in the entire Section is summed up and presented.

Distribution among Informative Contents

- Activation : 100%
- Demonstration : 0%
- Application : 0%
- Integration : 0%

Distribution among Instructive Contents

- Activation : 0%
- Demonstration : 95%
- Application : 0%
- Integration : 5%

Overall informative representation : 9%
Overall instructive representation : 91%
Observation

It is clearly demonstrated that the slide presentations are treated in two instructional styles, namely:

v) Informative

Concepts are merely presented with ‘What is What’ as only information and not describing as ‘Why and/or How’ on the conceptual basis.

vi) Instructive

Concepts are instructed as ‘What, How, Why and Where’ basis. This kind of instruction is called ‘Demonstration’ according to the First Principles of Instruction (Merrill 2007).

Accordingly the slide presentations are grouped into the above two categories. It is evidenced from the content analytical results on this Section, that the ‘Informative’ presence is much higher (88:12) than ‘Instructive’ style in this Section III on ‘2D Transformations’. It is observed from the one part that the ‘Demonstration’ cognitive structure is the predominant portrayal in both the cases. It is also observed that the slides with pictures/diagrams are more instructive rather than informative unlike the slides with textual information.

4.2.4 Section IV 3D Graphics

This Section is divided into 11 parts. The titles of these parts along with other data are presented in sub sections (that follow) and also in Table 4.4. The acronym RWP once again represents ‘Real World Problem’, as per the definition of ‘First Principles of Instruction’. Results obtained from each part are presented along with observation. Total number of parts in this Section is 11 and total number of slides available is 38.
4.2.4.1 Part 1 Introduction

Total number of Slides: 2

Distribution of Informative Cognitive Structures

Figure 4.54 Distribution of Informative Cognitive Structures on Introduction

Distribution of Instructive Cognitive Structures

Figure 4.55 Distribution of Instructive Cognitive Structures on Introduction
Observation

Introductory portion of any subject material even though would be informative, the absence of ‘Activation’ particularly (see Figure), reveals that this part is ineffective in instruction point of view.

4.2.4.2 Part 2 Arbitrary Rotation

Total number of Slides: 4

Distribution of Informative Cognitive Structures

![Diagram showing distribution of cognitive structures with Integration 0%, Activation 14%, No RWP, Application 14%, and Demonstration 44%]

Figure 4.56 Distribution of Informative Cognitive Structures on Arbitrary Rotation
Distribution of Instructive Cognitive Structures

![Diagram showing the distribution of cognitive structures with percentages: Integration 14%, Activation 0%, Application 0%, Demonstration 14%, and No RWP.]

**Figure 4.57** Distribution of Instructive Cognitive Structures on Arbitrary Rotation

**Observation**

This part is a good representation of FPI, but for the position of ‘Application’, when it would be better as instructive. Fairly good distribution of cognitive structures is seen.
4.2.4.3 Part 3 Projections

Total number of Slides: 4

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures on projections]

Figure 4.58 Distribution of Informative Cognitive Structures on Projections

Distribution of Instructive Cognitive Structures

![Diagram showing distribution of instructive cognitive structures on projections]

Figure 4.59 Distribution of Instructive Cognitive Structures on Projections
Observation

This part is purely demonstrative as observed. ‘Projections’ need to be ‘demonstrative application’. Hence some worked out examples (‘Application’) should have been included.

4.2.4.4 Part 4 Perspectives

Total number of Slides: 4

Distribution of Informative Cognitive Structures

Figure 4.60 Distribution of Informative Cognitive Structures on Perspectives
Distribution of Instructive Cognitive Structures

Figure 4.61  Distribution of Instructive Cognitive Structures on Perspectives

Observation

An exactly similar situation like the previous case is observed. A pure demonstrative instructional episode.
### 4.2.4.5 Part 5 Parallel Projection

Total number of Slides: 6

**Distribution of Informative Cognitive Structures**

![Diagram of Informative Cognitive Structures](image)

**Figure 4.62 Distribution of Informative Cognitive Structures on Parallel Projection**

**Distribution of Instructive Cognitive Structures**

![Diagram of Instructive Cognitive Structures](image)

**Figure 4.63 Distribution of Instructive Cognitive Structures on Parallel Projection**
Observation

This part and the next two parts demonstrate clearly that these episodes are purely demonstrative. Although instructions would be clear as observed from the instructor point of view, some inclusions on ‘Integration’ along with other portrayals would have increased the instructional effectiveness.

4.2.4.6 Part 6 3D Viewing

Total number of Slides: 6

Distribution of Informative Cognitive Structures

![Diagram of cognitive structures distribution]

Figure 4.64 Distribution of Informative Cognitive Structures on 3D Viewing
Distribution of Instructive Cognitive Structures

![Diagram showing the distribution of Instructive Cognitive Structures.]

**Figure 4.65** Distribution of Instructive Cognitive Structures on 3D Viewing

### 4.2.4.7 Part 7 Implementation

Total number of Slides: 2

Distribution of Informative Cognitive Structures

![Diagram showing the distribution of Informative Cognitive Structures.]

**Figure 4.66** Distribution of Informative Cognitive Structures on Implementation
Distribution of Instructive Cognitive Structures

![Distribution of Instructive Cognitive Structures](image)

Figure 4.67 Distribution of Instructive Cognitive Structures on Implementation

4.2.4.8 Part 8 Viewing Pipeline

Total number of Slides: 2

Distribution of Informative Cognitive Structures

![Distribution of Informative Cognitive Structures](image)

Figure 4.68 Distribution of Informative Cognitive Structures on Viewing Pipeline
Distribution of Instructive Cognitive Structures:

![Diagram showing distribution of cognitive structures](image)

**Figure 4.69  Distribution of Informative Cognitive Structures on Viewing Pipeline**

**Observation**

Yet another example of typical demonstrative instruction, while 80% (Figure 4.69) of it is informal, the rest is informative in nature. No other cognitive structure is found to be present in the two slides. Instruction would not be very effective.
4.2.4.9 Part 9 Camera Model

Total number of Slides: 1

Distribution of Informative Cognitive Structures

Figure 4.70 Distribution of Informative Cognitive Structures on Camera Model

Distribution of Instructive Cognitive Structures:

Figure 4.71 Distribution of Instructive Cognitive Structures on Camera Model
Observation

‘Camera Model’ need to be effective with the inclusion of ‘Integration’ and that is what seen with informative portion, while the rest is again found to be demonstrative. Even the demonstrative portion mostly is found to be informative.

4.2.4.10 Part 10 Viewing Pyramid

Total number of Slides: 1

Distribution of Informative Cognitive Structures

![Diagram showing distribution of informative cognitive structures with labels: Integration 0%, Activation 0%, Application 0%, Demonstration 0%, and No RWP.]

Figure 4.72 Distribution of Informative Cognitive Structures on Viewing Pyramid
Distribution of Instructive Cognitive Structures

Figure 4.73 Distribution of Instructive Cognitive Structures on Viewing Pyramid

Observation

This and the next parts are found to be highly and purely demonstrative. ‘Viewing Pyramid’ and ‘Viewing Transformation’ (next part) require certainly some presence of other categories of cognitive structures, which is not found to be present. Instruction in both the parts will not be effective.
4.2.4.11 Part 11 Viewing Transformation

Total number of Slides: 6

Distribution of Informative Cognitive Structures

<table>
<thead>
<tr>
<th>Integration 0%</th>
<th>Activation 0%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No RWP</td>
</tr>
<tr>
<td>Application 0%</td>
<td>Demonstration 0%</td>
</tr>
</tbody>
</table>

Figure 4.74 Distribution of Informative Cognitive Structures on Viewing Transformation

Distribution of Instructive Cognitive Structures

<table>
<thead>
<tr>
<th>Integration 0%</th>
<th>Activation 0%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No RWP</td>
</tr>
<tr>
<td>Application 0%</td>
<td>Demonstration 100%</td>
</tr>
</tbody>
</table>

Figure 4.75 Distribution of Instructive Cognitive Structures on Viewing Transformation
4.2.4.12 Overall Cognitive Structures in Section IV ‘3D Graphics’

The overall presence of cognitive structures in Section IV is briefed along with facts and examples as existing in actual slide.

Example(s):

3. On ‘Demonstration’

“Arbitrary Rotation, Assume we want to perform a rotation about an axis in space passing through the point \((x_0, y_0, z_0)\) with direction cosines \((c_x, c_y, c_z)\) by degrees”.

4. On ‘Application’

“Typical applications areas are ….

- Object Space
- World Space
- Eyespace
- 3D Image Space
- Screen Space

The summary of data pertaining to cognitive structures of instruction is presented in Table 4.4.
### Table 4.4 Cognitive Structures in Section IV on ‘3D Graphics’

<table>
<thead>
<tr>
<th>Part No.</th>
<th>No. of Slides</th>
<th>Title</th>
<th>Informative</th>
<th>Instructive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A  D  Ap  I</td>
<td>A  D  Ap  I</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Introduction</td>
<td>66% 34%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Arbitrary Rotation</td>
<td>14% 44% 14%</td>
<td>14% 14%</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>Projections</td>
<td>72% 28%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Perspectives</td>
<td>25% 75%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Parallel Projection</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>3D Viewing</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>Implementation</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>Viewing Pipeline</td>
<td>20% 80%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Camera Model</td>
<td>50% 25%</td>
<td>25%</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>Viewing Pyramid</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>Viewing Transformation</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

The overall presence in the entire Section is summed up and presented.

**Distribution among Informative Contents**

- Activation: 4%
- Demonstration: 76%
- Application: 4%
- Integration: 16%

**Distribution among Instructive Contents**

- Activation: 0%
- Demonstration: 98%
- Application: 0%
- Integration: 2%

Overall informative representation: 33%
Overall instructive representation: 67%
Observation

It is clearly demonstrated that the slide presentations are treated in two instructional styles, namely:

vii) Informative.

Concepts are merely presented with ‘What is What’ as only information and not describing as ‘Why and/or How ‘on the conceptual basis.

viii) Instructive

Concepts are instructed as ‘What, How, Why and Where’ basis. This kind of instruction is called ‘Demonstration’ according to the First Principles of Instruction (Merrill 2007).

Accordingly the slide presentations are grouped into the above two categories. It is evidenced from the content analytical results on this Section, that the ‘Informative’ presence is much higher (88:12) than ‘Instructive’ style in this Section IV on ‘3D Graphics’. It is observed from the one part that the ‘Demonstration’ cognitive structure is the predominant portrayal in both the cases. It is also observed that the slides with pictures/diagrams are more instructive rather than informative unlike the slides with textual information.

4.3 INFERENCES AND SUMMARY

1. It is clearly demonstrated from the content analytical study performed on different slides of different parts of Sections of CG e-course materials of NPTEL.that ‘cognitive structures’ of FPI can well be considered for quantification for further research for attempting to propose an effective instruction and implementing model.
2. Significant difference is seen in the distribution of cognitive structures between the two chosen portion of pedagogy namely ‘informative’ and ‘instructive’. In fact in many cases drastic difference in the presence of cognitive structures are seen. It is essential to differentiate between these two.

3. It is observed that ‘Demonstration’ cognitive structure is the most predominant portrayal found in both the portions.

4. ‘Activation’ seems to be rarely present in the slides, while ‘Integration’ is found to be reasonably present.

5. It is also observed that ‘Application’ of the ‘First Principles of Instruction’ is rarely seen. In many cases it could have been represented easily.

6. The above inferences would be of immense use to this research work, which will be followed on in the next chapter. Since the quantification has indicated haphazard presence of portrayals, ‘learning’ mathematics would not be effective. However, these portrayals can be taken as learning components for the proposed model.

One of the research objectives (chapter I) has clearly indicated the necessity for determining appropriate instructing strategies for evolving an instructional model for e-content development. Accordingly the chosen cognitive structures of FPI can be adapted as learning strategies for the proposed model. The need for proposing an effective instructional cum implementing model is now been established on the basis for this study. This chapter (content analysis) has thus contributed significantly in establishing that the cognitive structures may also be used as base in the proposed model.
Besides, the results provided in this chapter have also clearly demonstrated that even though the cognitive structures are unevenly and in an un-structured way present, the learning abilities can be represented in quantifiable ‘constructs’ in any model. Based on these findings, other factors influencing learning constructs and the strategies in which these constructs could be placed in the model will be researched upon in the next chapter.