The Curriculum Design and Implementation of Problem-based Learning in Graphic Communications

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Abstract **- This study covers curriculum developments in graphic communication areas through problem-based learning, PBL. With "commercial photography" selected as the topic, first, three learning cases are developed using learning goal analysis, and core capability concept mapping design. Through repeated implementation processes, corrections are made along the way. Basing on this experience, learning case examples are proposed. Lesson plan writing skills are classified and filed to provide professional vocational learning and serve as reference for students in technology and innovation related curriculums.**

Keywords: Problem-based Learning, Commercial Photography

PREFACE

Problem-based learning is a type of learning method in which idealism is incorporated in actual implementations. It started as early as 1950~1960 in medical areas [1].

It features positive learning essence of PBL that leads learners to creativity and problem solving methods. It differs from traditional memory learning that lacked knowledge integration and knowledge application in the learning models [1]. In terms of assessment, traditional learning methods frequently adopted quantitative assessment and focused on conclusive assessment results. On the other hand, PBL takes both quality and quantity into consideration. Both the "learning process" and the "result" are given consideration. [2].

During the PBL curriculum development course, teachers first formulate new knowledge, thoughts or models and transfer such knowledge through 3 channels listed below: [3]:1. Students acquire knowledge through teacher experience and knowledge imparting; 2. Students acquire knowledge through knowledge sharing among peers; 3.Knowledge is verified through case study and topic production. Through the above mentioned processes, students are able to formulate new knowledge, induce, apply, and innovate. PBL curriculum design is completed while requirements both in theory and in practice are taken into consideration.

In view of the breadth and complexity of learning, "Graphic Communication" was transformed into printing technique learning implications under the influence of technological changes prior to the 1950s. After 30 years, (1984) due to technological tool and aesthetic ideal integration, "Graphic Arts" emerged. After 1984, graphic basics were combined with multi-media. Driven by information technology, applied inter-media broadcasting implications were formed. Graphic communication technology learning content developments were still growing by then.

This study has introduced PBL method to cultivate the ideals of technological creativity. Through a series of experimental teachings, applied practical developments in the vocational education area, and learning content, basic curriculums in the graphic communication area have been selected. It is also the crucial up-stream output in the industrial processes-"commercial photography." Preliminary experimental results of the curriculum design and implementation in this area have been proposed.

Through curriculum analysis, and core capability concept mapping design, the development course of this curriculum is outlined. By means of stage play, 3 case

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studies, and 9 stage lesson plan contents have been formulated. After 3 years of implemented teaching and continual correction, this curriculum lesson plan review is compiled to share with those who share the same interest.

In terms of PBL-based and portfolio-based assessment on this curriculum implementation, [4], guidance practice, display, appreciation, and learning course record sheet are used to guide students in establishing learning files. They are expected to contribute to PBL curriculum developments described below:

CURRICULUM ANALYSIS

I. Unit Selection:

As commercialized dealings continue to grow, many commercial products are now placing importance on the effects of broadcasting. Therefore, applied "commercial photography" has become quite common. In the market, manpower training for commercial photography is mostly passing of skills from the master to the apprentice. If we take a look at the present curriculums offered in commercial photography training institutions, we may find that there is not a complete set of commercial photography teaching and learning model available. As a result, the lack of commercial product versatility and commercial photography capability makes it essential for a set of suitable teaching and learning model for commercial photography to be constructed in order to meet the growing demand for professional experts in commercial photography.

"Problem-based learning; PBL" uses the actual scenario of the existing cases as scripts. Under the guidance of the teacher, students practice on "problem discovery, problem analysis, and problem solving" from cases. Types of problems encountered in commercial photography conform to the problem-based essence of PBL. Thus, commercial photography is selected as an example in this unit. Applied photography curriculums in conjunction with problem-based learning methods not only allow one to learn product photography expression skills but also possess aesthetic disposition, vast knowledge, and high creativity. The learner is able to skillfully make use of equipments, and promote commercial benefits by means of innovative broadcasting contents. Through problem-based learning methods, the capability to solve problems and utilize knowledge is cultivated.

II. Fundamental Capability:

Before developing a professional skill, mastery in certain fundamental academic subjects is often essential so as to support future core capability setup. Professional knowledge can also be better understood during the learning process. In the following, fundamental capabilities needed for commercial photography learning are classified into 5 main scopes namely: art, mathematics, physics, chemistry, and communication:

- Art（picture design）:background setup, prop layout, and image presentation.

- Mathematics (calculation skill), exposure calculation (shutter, diaphragm), photo developing timing, photo taking distance, placement angle, and lighting angle.
- Physics (light wave principle): lighting feature (transmission, absorbance, diffusion, refraction, and reflection) lighting type (front light, indirect light, fog light, top light, side light semi-side light, and back light), lighting color (red, yellow, blue, green and purple).
- Chemistry (chemical principle), photo paper, (silver halide latent image developing), chemical changes of solution.
- Communication (communication principle): communication theory, marketing and sales plan, visual mentality, consumer mentality.

III. Core Capability

Repeated thinking is necessary when taking a good commercial product photo. Before taking a photo, target item feature, message conveyed by the vendor, photography equipment, and aesthetics view point should be combined to complete "photo-taking" that brings benefits. However, there is a great variety of target items in commercial photography. Photo taking style can also be adjusted depending on product feature, photographer preference, and vendor request. Therefore, although the various complex elements are interchangeably used, there is still a core capability during commercial photography learning. Based on this core capability, fundamental capability perception and learning are strengthened in order to be applied in other more in-depth areas. Consequently, single product categories are incorporated with appropriate combination elements to complete a piece of good commercial photography work. The main core capabilities of commercial photography include: product photo taking, photo taking model, photo taking equipment, lighting processing, lighting management, image aesthetics, and broadcasting effect classifications. The knowledge levels included are traced and mapped in Fig. 1.

IV. Learning Goal

After analyzing and understanding fundamentals needed by students in applied photography (commercial photography learning), the learning content of each stage is planned according to student level. The knowledge levels that should be learned are classified into core capability which is further divided into 3 learning goals. They include: "must learn," "should learn," and "nice to learn." Comprehensive learning goals are constructed in "applied photography (commercial photography learning) as shown in Table 1. In view of "applied photography," 3 individual cases and 9 stages are designed and planned. Learning level analysis is in subsequently conducted. (As shown in Table 2)

TABLE 1
APPLIED PHOTOGRAPHY LEARNING GOAL ANALYSIS

Subject implementation	Must learn	Should learn	Nice to learn

Applied photography	1. Operating view camera 2. Operating digital camera 3. Lighting type 4. Basic lighting skill 5. Light-sensitive material feature 6. Basic picture formation principle 7. Photography drafting 8. Image clarity level distribution and adjustment 9. Exposure meter use 10. Problem detection capability	1. Lighting methods of different material 2. atmosphere expressions of different materials 3. Photography draft design 4. Relationship between gray card, EV, metering, and exposure 5. Plane printing advertising expression methods 6. Problem solving capability	1. Media feature 2. Visual to mental conveyance 3.Extended thinking

Insert Appendix 1 above here.

TABLE 2
APPLIED PHOTOGRAPHY IN STAGED CASE LEARNING GOAL ANALYSIS

Unit	Stage	Must learn	Should learn	Nice to learn
Hardbound Book Takes A New Form!	Stage1	1. 120 photo negative feature 2. Instant photo operation and feature 3. True color presentation 4. Book array method	1.Shadow processing 2.Background and prop selection	1. Plane printing advertising expression method 2. Book binding method
	Stage 2	1. Image clarity level distribution and adjustment 2.Visual focus presentation	1. Photo presentation 2. Layer, consistency, and contrast control	1.Book printing feature
	Stage 3	1. Topic and atmosphere coordinateness 2. Cause for color variation 3. Color-sensitive material feature	1. Light angle 2. color deviation processing	1. Book processing and gilding feature
Twitching Eyes!	Stage 1	1. Target item cleaning method 2. Exposure calculation 3. Layout skill	1. Transparent object transmission and diffusion processing 2. Broadcasting focus-cool summer	1. Disparity from image media to plane media 2. Broadcasting realization
	Stage 2	1.Prop selection and display method 2. Transparent material outline expression 3. Effects of studio, light and color temperature	1. Light quality creation 2. Topic outline skill	1.Photography picture color expression method
	Stage 3	1. Color combination 2. Relationship between scale used and original scale 3. Relationship among farness/nearness, scale, perspective, and focal lens	1. Plane printing advertising disparity 2. 2D and 3D expression method 3.Relationship between photo viewing angle and photography angle	1. Public advertising focus
Watch Out! "Light of the Knife and Shadow of the Sword"	Stage 1	1. Digital camera operation 2. Strong contrast adjustment 3. metal reflection processing 4. Inverted image processing	1. Metal sharpness, texture expression 2. Disparity and limitation of digital imaging and light-sensitive film	1. Electronic and commercial image requirement 2. Relationship between media advertising mode and camera selection
	Stage 2	1. Glare processing method 2. Auxiliary equipment selection 3. Reflective object lighting and side light	1. Material atmosphere change skill 2. Cause for dirt production	1. Lightness/darkness contrast control
	Stage 3	1. Correct exposure and focal determination 2. Photography perspective and correct scale adjustment	1. Metal texture processing 2.Arc expression in 2D space	1. Consumer motive and consumer mentality

CORE CAPABILITY CONCEPT MAPPING

Concept mapping is a display concept of two dimensions between concepts and hierarchical connections. In other words, the learner expresses the knowledge structure learned through picture concept mapping [5]. Therefore, before lesson plan writing, fundamental capacity and core capability of learning content should first be compiled. Conceptual analysis is subsequently conducted. Analyzed capability structure are categorized and grouped as to hierarchy. Through concept mapping, knowledge relevance is presented in clarified and simplified manner. Based on concept mapping, stage scenarios of the lesson plan are then designed [6]. Through concept mapping use; more comprehensive lesson plan scenarios can be designed. They will aid in problem design presentation and interpretation. Take "applied photography" for instance; core capability concept mapping is proposed as shown in Fig. 2. See Figure 2 in Appendix 2.

COURSE OF DEVELOPMENT

Insert Appendix 3 above here.

LESSON PLANING

I. Teaching Case:

The lesson plan design is crucial to the success of the entire problem-based learning. There has to be a good lesson plan design in order to inspire student thinking capability toward problems and develop the thirst for knowledge through derived problems. Students will be encouraged to actively learn and have the desire to search for new knowledge. In terms of lesson plan content design for "applied photography," there are three cases and nine stages classified as to "photography" feature. Other than textual descriptions on problems, each stage has added "hint pictures" to highlight the features of problems in each stage. In addition, depending on user difference, problem-based learning experimental material-"applied photography" is divided into: "teacher edition" and "student edition."

Case No., case topic, writer, stage content, and hint picture in "applied photography" lesson plan content is generally the same for both the "student edition" and the "teacher edition." However, there is "recommended time allotment," "hint question" and "main discussion point" in the "teacher edition" while there is "brain storming," and learning pointer" in the student edition for self-filling by

students. Since the "teacher edition" and "student edition" lesson plan scenarios have identical scenario descriptions and hint pictures, only the "teacher edition" is included in Case 1 "Hardbound Book Takes A New Form" due to limited space available. The lesson plan content for first stage is as shown in Table 3. "

II. Implementation Schedule

With "applied photography" curriculum as the main lesson plan design axis, the curriculum time allotted is one semester. It includes simulated teaching, and three cases namely: "Hardbound Book Takes A New Form!," "Twitching Eyes!," and "Watch Out! Light of the Knife and Shadow of the Sword" Each case stage is classified into problem discovery and discussion prior to data collection, and problem solving and discussion after data collection. Time allotted for each stage discussion is 1.5 hours. Furthermore, other than simulated teaching, each learning case includes processes such as 3-stage simulated scenario guidance practice, display and assessment.

TABLE 3
SAMPLE OF LEARNING CASE (TEACHER EDITION)

Case No. PBL-CP-01
Case topic: Hardbound Book Takes A New Form!
Editor: Tsu-Ming Wu, Li-Ting Chen

Stage 1
Scholar Publishing Co. has recently published a series of hardbound books. Since a great amount of money had been spent on editing and printing, the publishing company wished to select a photography vendor through bidding in order to have exquisite plane printing advertising for this series of expensive hardbound books within sales budget.
After Mr. Cheng graduated from school, he entered a commercial product photo company to work due to his enthusiasm in photography. He has being served as the photographer's assistant for quite some time now. Recently, the company has joined the new book plane printing publishing bidding held by Scholar Publishing Co. In order to find out Cheng's capabilities, the photographer decided to let him sketch the draft for the photography bidding.
To attain such goal, Cheng first researched on the needs and expectations of the publishing company. While images and ideas were still lingering in his head, he sketched them on paper with a pen. After several corrections on the draft, he expressed the luxurious and high quality printing as the cover of the hardbound book. Extraordinary image and disposition were presented.
The publishing Co. decided to adopt Cheng's ideas and turned to an outsourced photo company to produce a colored advertisement. Cheng felt pleased to have gained such recognition on his first bidding participation so he frequently communicated with the publishing Co. During the discussion process, a 60mm*70mm color positive was selected as the size for his picture presentation.
From the draft sketched, Cheng began setting up the site, lighting, and photo taking tool/equipment. After his preliminary draft was completed, he anxiously observed the positive. Unfortunately, he discovered that the shadows made the book look rather "complicated" in the photo and seemed to be overlapping. He was devastated by the fact that the whole picture looked as if it were coated with grayish white fog. The colors were not saturated enough so the image looked distorted.
A- Jay passed by and saw the saddened look on Cheng's face. He tried to console him by saying, "Come on! It's your first time! It is a remarkable picture considering it is just a softbound book!" Cheng burst out crying and pointed at the hardbound books on the table. A-Jay glanced in the direction of the books and realized what was going on. He said, "Oh, I am so sorry. I am near-sighted! I didn't look carefully. Please forget what I had just said. I'll see you later!"

[Hint picture]   [Pointers for teachers]

1. Recommended time allotment:
   10 min brain storming,
   10 min problem stating
   30 min discussion
2. Hint questions:
1. How are image, value, and atmosphere presented in visual language?
2. What are the picture formation principles for image, prop, and background?
3. What are the reasons for photo size and type selection?
3. Main discussion focus
1. What are the expression methods for plane printing advertising
2. What is the relationship among light source, photo target, camera, and color-sensitive material?

III. Situated Teaching

"Simulated teaching case" aims to guide students to participate in PBL learning method demonstration implications. In this simulated teaching content, the differences between the "teacher edition" and "student edition" are distinguished. One difference is that the "teacher edition" has "induced problem examples," and "main discussion pointers" but the "student edition" does not. Meanwhile, during the teaching process, teachers not only distribute the "student edition" simulated lesson plan to students, actual picture examples of applied photography on the various published media are also played. Negatives of cases taken in studios also serve as sample pictures. 80 slides of commercial products are shown randomly. Students are requested to ask further questions after picture showing. Messages conveyed are then arranged and compiled.

IV. Guidance Practice

- **Time :** 7 hours
- **Venue :** studio
- **Learning content:** Due to limited space available, only case 1 is presented. <u>Case 1: Hardbound Book Takes A New Form!</u> 120 colored positives are used in groups. Depending on planning needs of "Hardbound Book Take A New Form!" various EV ratio photo taking statistics, draft sketching, light source design, and photo taking angle are taken into consideration. After photo taking, results are accordingly recorded in A4 format as listed below. （Fig. 3.）Although the direction of planning is the same, should be expressed differently to complete individual works and records.（Fig. 4.）
- **Learning method**: Each team members plays roles as the designer, lighting coordinator, and photographer. Members should practice as a group.
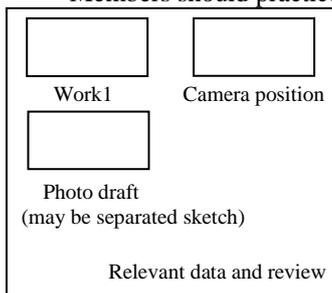

Work1   Camera position

Photo draft
(may be separated sketch)

Relevant data and review

FIGURE 3
WORK PHOTO RECORD FORMAT

FIG4 - SAMPLE OF STUDENT WORK PHOTO RECORD

Ⅴ. Display and Appreciation

- **Time :**1 hour
- **Venue :** studio
- **Learning content:** Depending on planning needs of the three cases: "Hardbound Book Takes A New Form!", "Twitching Eyes!", "Watch Out! Light of the Knife and Shadow of the Sword" individual photo taking records are completed, and results are displayed. Each team should assign a representative to report on the plan focus and photo taking feature.
- **Learning method:** Each team member pays roles as the publisher, the design photographer, and the reader. Problems are proposed and compiled before individual reporting.
- **Result compilation:** Shared reports are arranged and compiled before individual reporting.

Ⅵ. Group Discussion on Learning Course Record Sheets

Scholar recommended team discussion activity steps shall serve as reference [7]. In the "commercial photography" teaching sample, there are two discussions in each stage. Depending on the different discussion needs of the two discussion sessions, "work history learning file (1)" is designed: first group discussion-unit learning goals and mission distribution," and "work history learning file (2): second group discussion-practical learning history records." Depending on problem discovery prior to data collection, and problem solving and analysis after data collection, a set of complete discussion records should be established. In "Work History Learning File (1): First group discussion-unit learning goals and mission distribution," hypotheses are proposed based on problems discovered and questions proposed during the first stage discussion. Team members then setup self-learning goals and determine data collection method, range, and member in-charge. Through mission distribution and discovered problem discussion, students are trained fro the ability to discover problems and analyze hypotheses. It will indirectly help students to collect retrieved data and distribute missions. Through team discussion history records, students will be able to understand the learning pointers of the stage discussion and keep records for subsequent discussion and review purposes.

In "Work History Learning File (2): second group discussion-practical learning history record," other than the basic record items (such as unit topic name, stage category, activity time, and member etc.), there is also the speech record after data collection, and content pointer of knowledge sharing. Thoughts of other members and related issues are elaborated for further discussion. Through learning file record content, there will be something for members to feedback and ponder upon.

LESSON PLAN WRITING SKILL

Following scholar recommendation and expert guidance, the above mentioned are based on the essence of PBL. Through multiple teaching implementation corrections, "commercial photography" lesson plan content is completed.

After integrating reasonable theoretic basis and "commercial photography" lesson plan writing experience, "commercial photography" lesson plan serves as and example that contains compiled developmental and corrective lesson plan writing skills. Summary of this topic curriculum design and implementation:

- Fully understand curriculum subject and content in order to design suitable learning direction and focus.
- Sketch lesson plan development tree picture based on core capability concepts and control the entire lesson plan development and planning.
- Go beyond limitations of teaching procedures to facilitate lesson plan design.
- Note possible activity, problem scenario, and student life connections during curriculum implementation.
- Anticipated skill and attitude in conjunction with practical operation.
- There is no limited purpose to a problem. A teacher may handle the problem on his/her own or teachers may collaborate in teaching.
- Discover suitable problem points to elicit student questioning, data search and collection.
- Elicit learning motive and concern by integrating student needs, backgrounds, interests, and experiences.
- Prompt student creativity from ambiguous wordings developed based on problem points.
- Avoid direct problem statement that may lead to limited thinking and solution formulation.
- Avoid single answer, solution and instruction.
- Understand the differences among problem-based learning, problem solving, and topic-based learning. Clarify features of the three.

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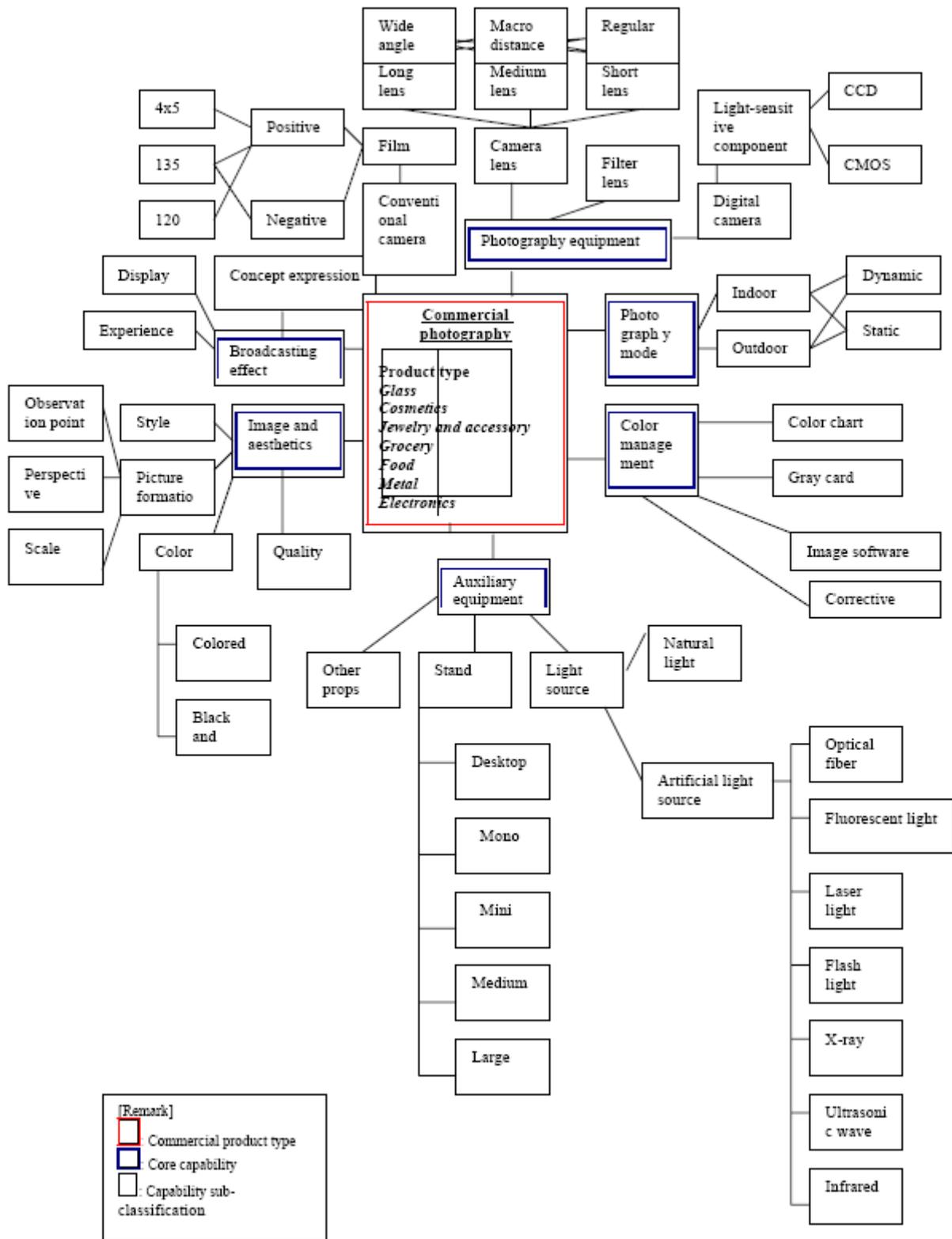
APPENDIX 1

FIGURE 1
COMMERCIAL PHOTOGRAPHY, PBL CORE CAPABILITY IMPLICATION

APPENDIX 2

FIGURE 2
CORE CAPABILITY CONCEPT MAPPING IN APPLIED PHOTOGRAPHY

APPENDIX 3