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RESEARCH ARTICLE**

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Cogent Education (2016), 3: 1178364



Received: 24 October 2015
Accepted: 11 April 2016
Published: 01 August 2016

*Corresponding author: Zainuddin Ibrahim, Faculty of Education, Department of Curriculum & Instructional Technology, University of Malaya, Kuala Lumpur 50603, Malaysia
E-mail: macintag@siswa.um.edu.my

Reviewing editor:
Shuyan Wang, The University of Southern Mississippi, USA

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Needs analysis for graphic design learning module based on technology & learning styles of deaf students

Zainuddin Ibrahim^{1*}, Norlidah Alias¹ and Abu Bakar Nordin¹

Abstract: The field of Information Communication Technology has offered a promising future for deaf students. Web design, animation, and multimedia application design are a branch of graphic design area, which aim to aid their learning visually. However, most of the technical terms cannot be interpreted in Malaysian sign language. Moreover, the development of the existing curriculum is not geared in catering needs of deaf students and not tailored to their learning styles. With the development of technology, learning for deaf students could be improved. However, previous studies only focused on language development and there is meager research on curriculum development and teaching in the field of graphic design. Therefore, this study was designed to obtain the views of students on the learning needs of graphic design module based on technology and learning styles of deaf students. Questionnaires were distributed to 58 students in special education schools and vocational colleges in Malaysia who majored in graphic design. Descriptive analysis of the data indicated that there is a need for a learning module and the reasons include difficulties in learning animation, different learning styles, communication of sign language in learning, and the efficacy of technology in aiding teaching deaf students.

Subjects: Animation; Arts; Computer Science; Design; Digital Art; Gaming & Animation; Graphic Design; Internet & Multimedia; Multimedia

Keywords: ICT; graphic design; technology; learning styles; deaf; learning module



Zainuddin Ibrahim

ABOUT THE AUTHOR

The main author is from Kuala Lumpur, Malaysia, and was born on 13 May 1980. He obtained his master's degree in Visual Communication & New Media in Universiti Teknologi MARA, Shah Alam, Malaysia in 2008.

PUBLIC INTEREST STATEMENT

This article is useful for identifying the needs of deaf students about motivation for graphic design field, the most difficult graphic design course to learn, the necessary communications in deaf learning, hardware and technology resources required, and the different learning styles of the deaf students. This article can provide input to the researchers, teachers, lecturers, and educational institutions to determine which elements need to be present for deaf students.

1. Introduction

According to a study conducted by Zaharudin, Nordin, and Mohd Yasin (2011), a field that involves information communication technology (ICT) such as website design, animation, and multimedia application design was highly demanded by deaf students. Landa (2006) explains that website design, animation, and multimedia application design are branches of graphic design. Although deaf students have a high tendency to study graphic design, there are some constraints faced. Among them are the inefficient technology used for learning, negligence of deaf students' learning styles, and the sign language interpreters were not experts in graphic design field. Furthermore, a number of terms cannot be translated and thus led to misunderstanding. In addition, the available learning modules used were not tailored to the needs of deaf students. Therefore, this study was conducted to provide a possible solution. In doing so, the grand tour question of this study is: "What is the needs of graphic design learning module based on technology and deaf students learning styles?" This study aimed to investigate the requirements of graphic design module based on technology and learning styles of deaf students. The end results of this findings will therefore be relevant in adding flesh to the current body of literature on deaf students learning graphic design course. Also, the analysis might serve as a point of reference in identifying the difficult topics in this course, justifying relevant technological tools, and understanding their preferences and learning styles in enhancing the quality of learning.

The available studies in Malaysia are still inadequate, even with the increasing attention and encouragement from various parties to help the students. Most books published in Malaysia were not specific to deaf students and emphasized more on generic skills to the disabled. To date, Yahya-Isa (2004) has contributed to this field by focusing more on the plight of deaf students, the public awareness on the future of deaf students, and help to be given. She has also conducted research on the importance of an appropriate curriculum for deaf students. She also studied the curriculum of deaf students because it is found to be different from typical students. She stresses on education for deaf students and calls for a different approach because of the limited use of verbs to describe abstract concepts. She admits that deaf students need vocational training to be employed in Malaysia, as most deaf students were still unemployed because they have limited skills. The results of her study showed that learning for deaf students should be focused on science, technology, and design (Yahya-Isa, 2004).

2. Curriculum

According to Alias (2010), curriculum is the learning experience provided in the learning module. The task is to identify the learning that has values to society and current civilization. Also, it is important to identify the most effective strategies in the delivery process to achieve the goals. The origin of graphic design curriculum is less discussed in the literature. Hence, it is still objective when it was introduced. Thus, it derives from the existing other curriculum theories. The basis of the curriculum is divided into reality, man, knowledge, value and morality, society, learning, and instruction (Alias, Nordin, Siraj, & Abdul-Rahman, 2014). In this study, researchers employed Isman model (Isman, Banmy, Hussein, & Al-Saadany, 2012). The main objective of Isman model is to guide planning, developing, executing, evaluating, and assuring effectiveness of the intended learning activities.

In practice of learning in Higher Education Institutions, interpreter should be able to interpret the language presented for the deaf. However, interpreting services are from volunteers and thus are not fixed. Therefore, the interpreter might not be available for a longer period and thus the teaching and learning. This conflict has also resulted in poor understanding of the content and context of learning. According to a survey conducted by Marschark, Bull, Sapere, and Lee (in press), Marschark, Sapere, Convertino, and Pelz (2008), deaf students can learn as regular students when taught by teachers who are skilled in sign language. While most teachers use the services of a language interpreter in the classroom or lecture, some disruptions during the learning process are constantly occurring (Krause, Kegl, & Schick, 2008). It is also found that inappropriate interpreter position and interpreter have limited knowledge to translate (Miller, Kargin, & Guldenoglu, 2013).

Table 1. Four dimensions of Felder and Silverman’s (1988) learning styles

Dimension	Learning styles	The characteristic
Input	Visual	Visual learner can remember what they learn through picture, figure, flow charts, and demonstration. They would prefer learning with lots of graphics
	Verbal	Verbal learner prefers reading and repeated reading a few times
Perception	Sensing	Sensing learner prefers learning facts, solve problems in order to relate example, more careful in doing practical work, and like to relate with live outside the class
	Intuitive	Intuitive learner prefers to learn new things and do not like memorizing facts but prefers mathematics formulae and abstract
Process	Active	Active learner would better understand and remember what they learn through doing, discussing, and explaining to others. They prefer working in groups
	Reflective	Reflective learner would prefer to work alone and try to think quietly in order to solve problem
Comprehension	Global	Global learner can understand things in a holistic manner, but slow and unsystematic. They would prefer to relate knowledge or past experience to understand certain things
	Sequential	Sequential learner can understand better when instruction is delivered from easy to complex. They have difficulty to get the overview and relate with other subjects or disciplines

Clearly, deaf students need a different approach than non-deaf students. Studies showed that deaf students experienced learning difficulties due to the mismatch of methods used by teachers and learning styles of student. Identifying the unique learning style is very important to ensure students are engaged in the learning process (Graf, Kinshuk, & Liu, 2009; Larkin-Hein & Budny, 2001; Naimie, Siraj, Abuzaid, & Shagholi, 2010; Yang & Tsai, 2008). It is established that meeting the needs of teaching and learning style will improve students’ learning as well as provide efficacy and motivation to students. Studies have also shown that each student has their own learning style (Knors & Marschark, 2014). Therefore, deaf students should also be studied based on their style of learning. Although each student’s learning style is important to review, studies on deaf students’ learning styles are still inadequate (Pashler, McDaniel, Rohrer, & Bjork, 2008). According to Felder and Silverman (1988), learning styles are divided into four dimensions which are input, perception, process, and comprehension. Each of these four dimensions has two different styles. Table 1 summarizes the learning styles by Felder and Silverman (1988).

3. Learning by technology

The importance and necessity of technology in assisting deaf students learn more effectively have been established in many studies. Some researchers have developed specific software to assist students to have the opportunity to learn the same with students who do not have hearing problems (Knors & Marschark, 2014). According to Bottoni, Capuano, De Marsico, Labella, and Leviardi (2011), the production of multimedia material by Deaf-Centered Learning Environment (DALE) has helped

deaf students in overcoming learning difficulties. DALE is a multimedia learning platform, which is based on the concept of storytelling and likeness (Storytelling and Conceptual metaphors), and Cognitive Embodiment is adopted as a framework for the course in the form of sensorially critical. According to Bueno, Garcia, Castillo, and Borrego (2007), hearing-impaired students have difficulties to complete their studies at the tertiary level because of difficulties in reading comprehension. However, the complication was reduced with the implementation of e-learning. Chowdhuri, Parel, and Maity (2012) agreed that deaf students cannot be exempted from e-learning approach. The use of technology in learning has helped them largely.

There are a number of studies that have established the effectiveness of technology on the deaf student learning. For instance, Intelligent Thai text to Thai sign translation language for learning (Dangsaart, Naruedomkul, Cercone, & Sirinaovakul, 2008), multimedia application to change the text or voice to an animated sign language (El Ghouli & Jemni, 2009; Jemni & ELGhouli, 2008; Stewart, Allan, & Harrison, 2010), web 2.0 (Vrettaros, Argiri, Stavrou, Hrissagis, & Drigas, 2010), and the use of video (Debevc, Kosec, & Holzinger, 2010) have helped the teaching and learning processes. However, most of these research approaches have only focused on the areas of language and the field of graphic design is still lacking. Differently, this study emphasizes on the needs of deaf student toward technology adaptation in learning like the Internet, laptop, mobile devices, Web 2.0, video with language interpreter, animation, and web platform. The higher ranked needs will be chosen as the foundation in learning module development in future research.

4. Learning styles

Identifying the uniqueness of learning style is important to encourage students' involvement in learning process (Graf et al., 2009; Larkin-Hein & Budny, 2001; Naimie et al., 2010; Yang & Tsai, 2008). The outcome from previous research indicated that teaching with learning style adaptation helped increase students' performance and boost their motivation to learn (Aviles & Moreno, 2010; Franzoni & Assar, 2009; Saeed, Yang, & Sinnapan, 2009). In these researches, deaf student learning styles were measured using Index Learning Style (ILS) by Felder and Silverman (1988). This index determines four dimensions of learning style such as input (visual or verbal), process (active or reflective), perception (sensory or intuitive), and comprehension (global or sequential). This index consists 11 questions for each dimension. The highest score of any section indicated the type of student's learning style. To our knowledge, there is no evidence or practice on graphic design module development adapted for student learning styles, especially deaf students.

5. Graphic design learning module

Graphic design learning module is an integrated module which is equipped with learning resources to study graphic design topic, such as history of graphic design, typography, layout, animation, and others. This module needs to fulfill deaf students' requirement in the aspects of technology and deaf learning styles in order to reduce learning difficulties, especially in communication problem (Lopez-Colino, Tejedor, Porta, & Colas, 2011), and the need to repeat the lesson due to their weak memory (Hall & Bavelier, 2010). In short, deaf students can use this module easily as long they have an Internet connection. This module is also equipped with appropriate instruction model, but will be determined on next research.

6. Methodology

This study employed quantitative survey to obtain the views of deaf students' learning on the needs of graphic design module based on technology and learning styles. According to Idris (2010), survey is a descriptive research method. It is useful when researchers want to collect data related to a phenomena that can't be collected by observation, such as opinion regarding the needs of graphic design learning module. This method helps gain accurate information in the big sampling. In this study, the researchers employed purposive sampling method (the deaf students of graphic design course) for achieving the objective of this study.

Table 2. Demography of deaf students

Variables		Number of respondents	Percentage
Gender	Male	42	72.4
	Female	16	27.6
Institution	Special Vocational School	36	62.1
	Polytechnic	22	37.9
Age	16–20	52	89.7
	21–25	6	10.3

6.1. Respondent

The study was conducted on 58 deaf students of special vocational schools and polytechnic in Malaysia in the field of graphic design. Fifty-eight respondents consisted of 42 (72.4%) males and 16 (27.6%) female students. Twenty-two (37.9%) students are from polytechnic and 36 (62.1%) students are from special vocational schools. The majority of students aged from 16–20 years were 52 (89.7%) and 21–25 years were 6 (10.3%) students. Table 2 summarizes the demographic information of the respondents.

6.2. The instrument

The researchers developed the instrument based on the literature and expert reviews. This questionnaire has been constructed into six dimensions that consist of 116 questions on motivation for choosing the field of graphic design, the most difficult graphic design course, communication in deaf student learning, technology hardware, technology sources, and learning styles by Felder and Silverman (1988). For the first dimension, the motivation question consists of why they choose graphic design program in the first place. Are they influenced by others factors? Second dimension consists of the most difficult graphic design course to learn. The finding will be used for the next study on the development of graphic design course. The researchers wanted to focus on the difficult course because there was abundance of graphic design courses offered, but yet to be evaluated. Third dimension consisted of tool for communication in learning process. Deaf students face difficulty in communicating with the instructor. The tool is in form of software application like WhatsApp, Telegram, and others. Fourth dimension was the preferred hardware technology like computer and mobile devices. If the student preferred to use mobile devices, then the learning module should have the ability to run on the preferred devices. The fifth dimension consists of learning sources like video, game, animation, and other to ensure the students understood easily. Five dimensions of the survey used a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The last dimension consists of learning style. Learning style questions will indicate the preferred style for each dimension. Each dimension of learning style has two categories and will be determined by answering 11 questions. The learning style questionnaire was adapted from ILS by Felder and Silverman. All the questions were translated to Malay language. The questionnaire was piloted earlier on 30 deaf students and the reliability test showed that the items are reliable, with Cronbach's Alpha = 0.854. Then, the instruments were distributed into groups of three different special vocational schools and one polytechnic, after obtaining the permission from Ministry of Education Malaysia and their parents. Each group took one hour to complete the questionnaire. Researchers also conducted validity and reliability testing using SPSS software version 21, then analyzed the descriptive analysis by mean and standard deviation. According to Idris (2010), the best descriptive analysis for data summaries is mean and standard deviation.

6.3. Validity and reliability

To test the validity and reliability of the questionnaire, some experts have reviewed the language content and appropriateness. Researchers have used the estimated internal consistency. Cronbach's alpha (Cronbach, 1951) for each construct was 0.894, 0.929, 0.478, 0.766, 0.933, and 0.746. No items were dropped as the level of reliability was 0.893. To ensure normal distribution of the questionnaire,

normality tests have been conducted. For normality test, Shapiro–Wilk’s test ($p > .05$) (Razali & Wah, 2011; Shapiro & Wilk, 1965) shows the data are normal for men and women: with skewness 0.194 (SE = 0.365) and kurtosis -0.399 (SE = 0.717) for men, and skewness 0.389 (SE = 0.564) -0.211 and kurtosis (SE = 1.091) for women.

7. Findings and results

The findings of this study are expected to provide information on the needs for the graphic design module based on technology and learning styles of deaf students. Data obtained from questionnaire were collected and then subjected to descriptive analysis. Motivation to choose graphic design, the most difficult graphic design courses, tools for communication, hardware, and resources for learning have been analyzed by mean and standard deviation, while deaf learning style was analyzed by ILS score. The higher score indicated the dominant dimension of each learning style. All the needs will be indicators for the researcher to develop graphic design learning module based on technology and deaf students’ learning styles.

7.1. Motivation to graphic design field

Table 3 shows the majority of respondents feeling grateful to study graphic design with a high mean of 4.276 (SD = 0.720), followed by interest in graphic design with mean of 4.120 (SD = 0.623).

7.2. The most difficult course

Table 4 shows the most difficult graphic design course is animation which records the highest mean of 3.966 (SD = 0.837), followed by illustration and web design records of mean 3.741 (SD = 0.849) and 3.638 (SD = 0.852).

7.3. Communication

Table 5 shows majority of the respondents “agree” that the use of sign language and Facebook is required in learning graphic design, with same mean of 4.155 (SD = 0.768) and 4.155 (SD = 0.812), followed by communication through *WhatsApp* in learning graphic design with mean 4.120 (SD = 0.860).

7.4. Technology hardware

In Table 6, mean 4.155 (SD = 0.854) viewed that the use of the notebook (laptop) is required also followed by desktop with mean 4.120 (SD = 0.727).

7.5. Technology sources

Analysis of the data shown in Table 7 is the need for sources of technology in learning graphic design. The results showed that the respondents should use high-speed Internet with mean 3.948 (SD = 0.926) followed by video clips, with mean 3.931 (SD = 0.722).

7.6. Learning styles

Table 8 shows learning styles by Felder and Silverman for dimension process. The analysis indicated that the majority of respondents have an active learning style (65% with 417 score) compared to reflective learning style (34.6% with 221 score).

In Table 9, Felder and Silverman’s learning style for perception dimension showed that the students scored highest in sensing learning style with 65% (415 score) compared to intuitive learning style, which is only 35% (223 score).

According to Table 10, the results of the analysis showed that visual input scored a majority of 66.1% (422 score) compared to verbal input (33.9% with 216 score). It is undeniable that deaf students required visual learning sources to learn graphic design.

Table 3. Motivation of graphic design

Item	N	Mean	Std. deviation
1.1 Interest in graphic design	58	4.120	.623
1.2 Friend thought I was in accordance with the graphic design	58	3.586	.750
1.3 Family thought I was in accordance with the graphic design	58	3.810	.805
1.4 I like graphic design for many uses, visual	58	3.707	.749
1.5 I like graphic design for many uses, skills	58	3.914	.864
1.6 I have skills in graphic design	58	3.810	.661
1.7 I want to be a graphic designer	58	4.052	.711
1.8 Graphic design has many career opportunities	58	3.948	.782
1.9 Graphic design generates more income	58	4.051	.847
1.10 I have creativity	58	3.793	.669
1.11 Most of my friends in the graphic design field	58	3.879	.919
1.12 Graphic design is fun	58	4.017	.737
1.13 Graphic design is challenging	58	3.931	.722
1.14 Graphic design is popular in Malaysia	58	3.756	.757
1.15 Graphic design is professional	58	3.741	.690
1.16 Graphic design has bright future	58	4.034	.725
1.17 Graphic design expresses my feelings	58	3.724	.696
1.18 Graphic design is easy to learn	58	3.966	.700
1.19 I am not forced to learn graphic design	58	3.776	.727
1.20 Graphic design is my first choice	58	3.880	.677
1.21 I am happy to learn graphic design	58	3.982	.607
1.22 I am pleased to learn graphic design	58	4.051	.711
1.23 I am grateful to study graphic design	58	4.276	.720
1.24 I am honored to be able to study graphic design	58	4.103	.742

Table 4. The most difficult graphic design course

Item	N	Mean	Std. deviation
1.1 History of graphic design	58	3.293	.859
1.2 Fundamentals of Art and Design	58	3.328	1.205
1.3 Computer Application	58	3.535	1.188
1.4 Drawing	58	3.448	1.095
1.5 Photography	58	3.603	1.270
1.6 Typography	58	3.397	1.107
1.7 Digital Imaging	58	3.620	1.226
1.8 Illustration	58	3.741	.849
1.9 Multimedia	58	3.448	.902
1.10 Advertising	58	3.155	1.089
1.11 Corporate Identity	58	3.414	1.009
1.12 Web Design	58	3.638	.852
1.13 Animation	58	3.966	.837
1.14 Entrepreneur	58	3.293	1.140
1.15 Visual Merchandising	58	3.345	1.117
1.16 Portfolio	58	3.380	1.254

Table 5. Communication

Item	N	Mean	Std. deviation
1.1 I need to communicate with sign language	58	4.155	.768
1.2 I need to communicate using WhatsApp	58	4.120	.860
1.3 I need to communicate with the interpreter	58	3.707	.859
1.4 I can communicate with lip reading	58	3.310	1.173
1.5 I need to communicate with paper and pencil	58	3.982	.827
1.6 I need to communicate using email	58	4.138	.760
1.7 I need to communicate using Facebook	58	4.155	.812
1.8 I need to communicate using special software on the computer	58	3.776	.899
1.9 I need to communicate using Twitter	58	3.051	1.317

Table 6. Technology hardware

Item	N	Mean	Std. deviation
1.1 I need to learn using a computer desktop	58	4.120	.727
1.2 I need to learn using a laptop	58	4.155	.854
1.3 I need to learn using a smartphone	58	3.845	.988
1.4 I need to learn using a tablet	58	3.931	.953
1.5 I need to learn using the book	58	3.914	.779
1.6 I need to learn using television	58	3.621	.855
1.7 I need to learn using videos/game	58	3.949	.944
1.8 I need to learn using a whiteboard	58	3.620	1.023

Table 11 shows the learning styles of deaf students by comprehension dimension. Sequential learning styles achieved the highest with 61.6% (393 score) compared to the global learning styles which is only 38.4% (245 score).

8. Discussion

Motivation to graphic design field is a priority for deaf students. This statement has been proven by a research done by DeWitt, Alias, Ibrahim, Shing, and Rashid (2015) which clarifies deaf students prefer to enroll in graphic design course compared to other fields. Although the mean did not reach maximum five, the majority of students agreed that graphic design involves a lot of visual, computer, and technical skills. This makes the interest in graphic design deepen. These research findings are also in line with a research done by Zaharudin et al. (2011), which indicated that deaf students prefer to study graphic design because it involves ICT like web design, animation, and multimedia design. Deaf students are more likely interested in areas related to web design, animation, and applications design. However, feeling motivated and the interest alone are not enough to master the graphic animation course. Graphic animation is the most difficult course as indicated, compared to other courses offered. This is because the graphics animation should have a strong foundation of knowledge and skills. Students also need to skillfully use specific software to produce good animation. Therefore, the finding of this study will help future researchers to focus on the most difficult course in graphic design, which is animation. In addition, many studies show that animation helps deaf students learn better (Gambhir, Vishnoi, & Khan, 2015; Helior & Nunnari, 2015; Kacorri & Huenerfauth, 2014). According to Nunes, Barros, Evans, and Burman (2014), Hall and Bavelier (2010), deaf students have weak working memory and require repetition of learning. Therefore, technology is needed to help the learning process, especially for deaf students (Debevc, Stjepanovic, & Holzinger, 2014; Stinson, 2010). The analysis showed that technology plays an important role in learning. The students viewed that the hardware technologies such as the use of laptops are most important.

Table 7. Technology sources

Item	N	Mean	Std. deviation
1.1 I need to learn using video clips	58	3.931	.722
1.2 I need fast Internet speed	58	3.948	.926
1.3 I need to use WebQuest	58	3.155	.790
1.4 I need to use Padlet	58	3.466	.941
1.5 I need to use the website	58	3.362	1.021
1.6 I need to use Twitter	58	3.224	1.170
1.7 I need to use learning management system	58	3.397	1.059
1.8 I need to use Wiggio	58	3.397	1.008
1.9 I need to use a Tele-seminar	58	3.310	1.046
1.10 I have to use Edmodo	58	3.328	1.130
1.11 I have to use a social networking	58	3.224	1.125
1.12 I have to use Wordpress	58	3.724	.951
1.13 I have to use Twidla	58	3.224	1.140
1.14 I have to use Go Animate	58	3.379	1.197
1.15 I have to use Courseware	58	3.535	1.096

Table 8. Process dimension (Active (A) and Reflective (B))

Item	A Active	B Reflective
1	38 (65.5%)	20 (34.5%)
5	47 (81%)	11 (19%)
9	51 (87.9%)	7 (12.1%)
13	50 (86.2%)	8 (13.8%)
17	20 (34.5%)	38 (65.5%)
21	47 (81%)	11 (19%)
25	20 (34.5%)	38 (65.5%)
29	21 (36.2%)	37 (63.8%)
33	27 (46.6%)	31 (53.4%)
37	52 (89.7%)	6 (10.3%)
41	44 (75.9%)	14 (24.1%)
Total score	417 (65.4%)	221(34.6%)

While it is the primary need, the cost to get the best facilities is expensive. Students will not be able to be equipped with excellent equipment because most of them are from lower social income families. Thus, vocational schools and polytechnics should help students in providing the required hardware for learning.

Apart from good hardware, learning resources also play an important role in learning for deaf students. The majority of students choose high-speed Internet and video as a learning resource. This finding is significant with the research done by Ng'ethe, Blake, and Glaser (2015) that proves the use of video and high broadband Internet speed through mobile in deaf learning enabled successful learning. According to Ahmadi, Abbasi, and Bahaadinbeigy (2015), the combination of high Internet and video learning approaches promotes deaf students to learn effectively. Videos certainly have advantages such as to control the playback of content while high-speed Internet enabled faster video loading. Students who do not understand can repeat the video to reach a higher understanding. Students can also make a revision outside the classroom. However, the delivery methods used in the

Table 9. Perception dimension (Sensing (A) and Intuitive (B))

Item	A Sensing	B Intuitive
2	29 (50%)	29 (50%)
6	41 (70.7%)	17 (29.3%)
10	29 (50%)	29 (50%)
14	48 (82.8%)	10 (17.2%)
18	35 (60.3%)	23 (39.7%)
22	33 (56.9%)	25 (43.1%)
26	58 (100%)	0 (0%)
30	24 (41.4%)	34 (58.6%)
34	23 (39.7%)	35 (60.3%)
38	39 (67.2%)	19 (32.8%)
42	56 (96.6%)	2 (3.4%)
Total score	415 (65%)	223(35%)

Table 10. Input dimension (Visual (A) and Verbal (B))

Item	A Visual	B Verbal
3	37 (63.8%)	21 (36.2%)
7	43 (74.1%)	15 (25.9%)
11	43 (74.1%)	15 (25.9%)
15	38 (65.5%)	20 (34.5%)
19	20 (34.5%)	38 (65.5%)
23	48 (82.8%)	10 (17.2%)
27	33 (56.9%)	25 (43.1%)
31	48 (82.8%)	10 (17.2%)
35	36 (62.1%)	22 (37.9%)
39	25 (43.1%)	33 (56.9%)
43	51 (87.9%)	7 (12.1%)
Total score	422 (66.1%)	216 (33.9%)

Table 11. Comprehension dimension (Sequential (A) and Global (B))

Item	A Sequential	B Global
4	34 (58.6%)	24 (41.4%)
8	29 (50%)	29 (50%)
12	39 (67.2%)	19 (32.8%)
16	26 (44.8%)	32 (55.2%)
20	27 (46.6%)	31 (53.4%)
24	58 (100%)	0 (0%)
28	37 (63.8%)	21 (36.2%)
32	38 (65.5%)	20 (34.5%)
36	32 (55.2%)	26 (44.8%)
40	36 (62.1%)	22 (37.9%)
44	37 (63.8%)	21 (36.2%)
Total score	393 (61.6%)	245 (38.4%)

video must also be taken into account. From the aspect of communication, the majority of students agreed that the use of sign language is a key requirement. This finding supports the research done by Muhn and Jung (2015) that stated sign language video in deaf learning is very important. Thus, the description contained in the video should have a sign language translation. In this way, it would be easier for students to understand the content. In terms of platform of communication, deaf students preferred to use Facebook to communicate because it is a social networking application. This finding shows significance with the research done by Saunders (2016) that proves social media such as a Facebook serves the deaf community in a more positive manner. According to Chang (2015), digital mobile communication technology such as a Facebook has opened new communication opportunities and partly reduced the communication gap between deaf and hearing people.

In terms of learning styles, students showed a high percentage of active, sequential, visual, and sensory learning styles based on Felder and Silverman (1988). This is because deaf students depend on visuals. However, according to Knoors and Marschark (2014), being less dependent on hearing does not necessarily make deaf students better visual learners compared to hearing students. Although some of the students have verbal learning styles, students can use reading text. Identifying deaf learning styles is very important so that deaf students can learn more easily and effectively. This study focuses on the needs of deaf students in graphic design learning module based on technology and learning styles. The finding showed that the deaf students preferred active, sequential, visual, and sensory learning, but there were some students who preferred to learn through global, verbal, reflective, and intuitive learning styles. Therefore, graphic design learning module should consider all four dimensions of learning styles in their learning process. According to Felder and Silverman (1988), active learning styles required group activities, while reflective encouraged students to work alone. In addition, active students can complete the assignment faster than reflective students. So, for the reflective students, they required extra time to finish the task given. Sensing learning style required examples to ensure the students are aware of the bigger picture on what is happening. Sensing students have weak imagination compared to intuitive students under perception dimension. Differently, intuitive students have the capability to visualize the whole concept without giving example. Most of the students can understand well if contents were explained in sequential form, as they are easily demotivated. Based on the differences in deaf students' learning style, the graphic design learning module must be designed according to students' needs in order to ensure the effectiveness of their learning.

Overall, students showed the needs for graphic design field as the majority of students have feeling grateful and strong interest in this field. Despite feeling grateful and high interest in the fields of graphic design, the analysis shows that animation is a difficult course to learn and requires an appropriate approach. Means, communication, hardware technology, resources, and different learning styles should be taken into account. Thus, in the field of learning modules for graphic design, animation courses should be given an ample highlight and acknowledge their learning styles. This is in accordance with the Education Act 1961, the Education Act 1966, and the Malaysian National Education Association, as the curriculum should be tailored to the needs of deaf students, and to provide equal rights to effective education.

9. Conclusion

This study focused on needs analysis for graphic design learning module based on technology and deaf learning styles. There is no learning module developed in this study. The study was conducted in a Malaysian cultural context. The limitation of this study is that deaf students have difficulty in understanding the administered questions. So, researchers should consider to administer the questionnaire with the help of sign language interpreters. Besides, the numbers of deaf students are limited to 58 individuals from three special vocational schools and one polytechnic that took graphic design program. Furthermore, the researchers suggest other researchers to develop a graphic design module based on the needs analysis conducted. The implication of this study will contribute to the Ministry of Higher Education Malaysia, University, and educators in order to develop curriculum or learning modules, especially for graphic design area and deaf students.

Acknowledgement

The authors wish to thank the Ministry of Education Malaysia as this work was supported in part by a permission on conducting this research on representative vocational schools and polytechnics, especially for deaf students.

Funding

The authors received no direct funding for this research.

Author details

Zainuddin Ibrahim¹

E-mail: macintag@siswa.um.edu.my

ORCID ID: <http://orcid.org/0000-0001-6302-4614>

Norlidah Alias¹

E-mail: drnorlidah@um.edu.my

Abu Bakar Nordin¹

E-mail: a_bakarnordin@um.edu.my

¹ Faculty of Education, Department of Curriculum & Instructional Technology, University of Malaya, Kuala Lumpur 50603, Malaysia.

Citation information

Cite this article as: Needs analysis for graphic design learning module based on technology & learning styles of deaf students, Zainuddin Ibrahim, Norlidah Alias & Abu Bakar Nordin, *Cogent Education* (2016), 3: 1178364.

Cover image

Source: Author.

References

- Ahmadi, M., Abbasi, M., & Bahaadinbeigy, K. (2015). Design and implemented of a software for teaching health related topics to deaf students: The first experience in Iran. *Journal of Academy of Medical Sciences of Bosnia and Herzegovina*, 23, 76–80.
- Alias, N. (2010). *Pembangunan modul pedagogi berasaskan teknologi dan Gaya Pembelajaran Felder-Silverman kurikulum fizik sekolah menengah*. Universiti Malaya.
- Alias, N., Nordin, A. B., Siraj, S., & Abdul-Rahman, M. N. (2014). *Kurikulum Satu Disiplin Yang Dinamik*. Kuala Lumpur: Pearson Malaysia.
- Aviles, R., & Moreno, A. (2010). Creating the conditions for educational change: Learning styles and gender. *International Journal of Learning and Change*, 4, 252–262. <http://dx.doi.org/10.1504/IJLC.2010.035834>
- Bottoni, P., Capuano, D., De Marsico, M., Labella, A., & Levaldi, S. (2011). DELE: A deaf-centered E-learning environment. *Chiang Mai Journal of Science*, 38, 31–57.
- Bueno, F. J., Garcia, S., Castillo, J. R., & Borrego, R. (2007, June 25–27). E-learning content adaptation for deaf students. In *ITICSE'07*. Dundee.
- Chang, C. (2015). Innovation of a smartphone app design as used in face-to-face communication for the deaf/hard of hearing. *Online Journal of Art & Design*, 3, 1–16. Retrieved from <http://ojad.emu.edu.tr/articles/34/341.pdf>
- Chowdhuri, D., Parel, N., & Maity, A. (2012). *Virtual classroom for deaf people*. 2012 IEEE International Conference on Engineering Education: Innovative Practices and Future Trends. New York: Thomson Reuters.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297–334. <http://dx.doi.org/10.1007/BF02310555>
- Dangsaart, S., Naruedomkul, K., Cercone, N., & Sirinaovakul, B. (2008). Intelligent Thai text- Thai sign translation for language learning. *Computer & Education*, 51, 1125–1141.
- Debevc, M., Kosec, P., & Holzinger, A. (2010). Sign language interpreter module: Accessible video retrieval with subtitle. *LNCS (Lecture Notes in Computer Science)*, 6180, 221–228.
- Debevc, M., Stjepanovic, Z., & Holzinger, A. (2014). Development and evaluation of an e-learning course for deaf and hard of hearing based on the advanced adapted pedagogical index method. *Interactive Learning Environments*, 22, 35–50.
- DeWitt, D., Alias, N., Ibrahim, Z., Shing, N. K., & Rashid, S. M. (2015). Design of a learning module for the deaf in a higher education institution using padlet. *Procedia-Social and Behavioral Sciences*, 176, 220–226. <http://dx.doi.org/10.1016/j.sbspro.2015.01.464>
- El Ghoul, O., & Jemni, M. (2009). Multimedia courses generator for deaf children. *International Arab Journal of Information technology*, 6, 458–463.
- Felder, R., & Silverman, L. (1988). *Learning & teaching styles*. Retrieved 2014, from Learning & Teaching Styles in Engineering Education: <http://www4.ncsu.edu/unity/lockers/users/ff/felder/public/Papers/LS-1988.pdf>
- Franzoni, A., & Assar, S. (2009). Student learning styles adaptation method based on teaching strategies and electronic media. *Educational Technology & Society*, 12, 15–29.
- Gambhir, S., Vishnoi, S., & Khan, S. (2015). Animation: An effective tool for better teaching practices. *Metrix Academic International Online Journal of Engineering and Technology (MAIOJET)*, 6–8. Retrieved from <http://maioj.org/data/documents/04-02-01-02-PB.pdf>
- Graf, S., Kinshuk, & Liu, T. C. (2009). Supporting teachers in identifying students' learning styles in learning management systems: An automatic student modelling approach. *Educational Technology & Society*, 12, 3–14.
- Hall, M. L., & Bavelier, D. (2010). Working memory, deafness, and sign language. In M. Marschark & P. E. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education*, Vol. 2 (pp. 458–471). New York, NY: Oxford University Press.
- Helior, A., & Nunnari, F. (2015). *Towards an intuitive sign language animation authoring system for the deaf* (pp. 1–11). Springer. Retrieved from <http://link.springer.com/article/10.1007/s10209-015-0409-0>
- Idris, N. (2010). *Penyelidikan Dalam Pendidikan*. Kuala Lumpur: Mc Graw Hill Education.
- Isman, A., Banmy, F. A., Hussein, H. B., & Al-Saadany, M. A. (2012, January). Effectiveness of instructional design model (ISMAN-2011) in developing the planning teaching skills of teachers college students' at King Saud University. *The Turkish Online Journal of Educational Technology*, 11, 71–78.
- Jemni, M., & ELGhoul, O. (2008). A system to make signs using collaborative approach. In *Computers Helping People with Special Needs* (Volume 5105 of the series Lecture Notes in Computer Science) (pp. 670–677). Springer.
- Kacorri, H., & Huenerfauth, M. (2014). Implementation and evaluation of animation controls sufficient for conveying ASL facial expressions. In *Proceedings of the 16th International ACM SIGACCESS Conference on Computers & Accessibility* (pp. 261–262). NY. Retrieved from <http://dl.acm.org/citation.cfm?id=2661387>
- Knooks, H., & Marschark, M. (2014). *Teaching deaf learners*. New York, NY: Oxford University Press. <http://dx.doi.org/10.1093/acprof:oso/9780199792023.001.0001>
- Krause, J., Kegl, J., & Schick, B. (2008). Toward extending the educational interpreter performance assessment to cued speech. *Journal of Deaf Studies and Deaf Education*, 13, 432–450. <http://dx.doi.org/10.1093/deafed/enm059>
- Landa, R. (2006). *Graphic design solution* (3rd ed.). New York, NY: Thomson.
- Larkin-Hein, T., & Budny, D. (2001). Research on learning style: Applications in physics and engineering classroom. *Education*, 44, 276–281.

- Lopez-Colino, F., Tejedor, J., Porta, J., & Colas, J. (2011). Intergration of a Spanish-to-LSE* machine translation system into an e-learning platform. In C. Stephanidis (Ed.), *6th International Conference HCI* (4, pp. 567–576). Orlando: Springer.
- Marschark, M., Bull, R., Sapere, P., & Lee, C. (in press). *Supporting deaf students' mathematics learning in the college classroom*.
- Marschark, M., Sapere, P., Convertino, C., & Pelz, J. (2008). Learning via direct and mediated instruction by deaf students. *Journal of Deaf Studies and Deaf Education*, 13, 446–461.
- Miller, P., Kargin, T., & Guldenoglu, B. (2013). The reading comprehension failure of Turkish prelingually deaf readers: Evidence from semantic and syntactic processing. *Journal of Developmental and Physical Disabilities*, 25, 221–239.
<http://dx.doi.org/10.1007/s10882-012-9299-8>
- Muhn, S. H., & Jung, K. T. (2015). The effects of sign language video location in e-learning system for the hearing-impaired. *Journal of the Ergonomics Society of Korea*, 34, 597–607.
<http://dx.doi.org/10.5143/JESK.2015.34.6.597>
- Naimie, Z., Siraj, S., Abuzaid, R., & Shaghali, R. (2010). Did you cook based on the right recipe? (Accommodating the student preferences in class). *Social and Behavioral Sciences*, 2, 383–387.
- Ng'ethe, G. G., Blake, E. H., & Glaser, M. (2015). SignSupport: A mobile aid deaf people learning computer literacy skills. In *Proceeding of the 7th International Conference Supporte Education (CSEDU-2015)* (pp. 501–511).
- Nunes, T., Barros, R., Evans, D., & Burman, D. (2014). Improving deaf children's working memory through training. *International Journal of Speech & Language Pathology and Audiology*, 2, 51–66. Retrieved from <http://www.synergypublishers.com/jms/index.php/ijslpa/article/view/566/268>
- Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles: Concepts and evidence. *A Journal of the Association for Psychological Science*, 9, 106–119.
- Razali, N. M., & Wah, Y. B. (2011). Power comparison of Shapiro-Wilk, Kolmogorov-Shmirnov, Lilliefors and Anderson-Darling test. *Journal of Statistical Modeling and Analytics*, 2, 21–33.
- Saeed, N., Yang, Y., & Sinnapan, S. (2009). Emerging web technologies in higher education. A case of incorporating blogs, podcasts and social bookmarks in a web programming course based on students' learning styles and technology preferences. *Educational Technology & Society*, 12, 98–109.
- Saunders, K. C. (2016). A double-edge sword: Social media as a tool of online disinhibition regarding American sign language and deaf cultural experience marginalization, and as a tool of cultural and linguistic exposure. *SAGE Journal*, 1–9. Retrieved from <http://sms.sagepub.com/content/2/1/2056305115624529.full.pdf+html>
- Shapiro, S. S., & Wilk, M. B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, 52, 591–611. <http://dx.doi.org/10.1093/biomet/52.3-4.591>
- Stewart, L., Allan, M., & Harrison, D. (2010). The development of a lecture capture system based on a tool to support hearing impaired students. In M. Iskander, V. Kapila, & M. A. Karim (Eds.), *Technological developments in education and automation* (pp. 287–292). Palgrave Macmillan. doi:10.1007/978-90-481-3656-8_53
- Stinson, M. (2010). Current and future technologies in the education of the deaf students. In M. Marschark & P. E. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (Vol. 2, pp. 93–100). New York, NY: Oxford University Press.
- Vrettaros, J., Argiri, K., Stavrou, P., Hrissagis, K., & Drigas, A. (2010). Evaluation study of pedagogical methods and e-learning material via web 2.0 for hearing impaired people. *Technology Enhanced Learning: Quality of Teaching and Educational Reform*, 73, 595–601.
- Yahya-Isa, S. (2004). *Against all odds*. Penang: Forda Printing Sdn. Bhd.
- Yang, F., & Tsai, C. (2008). Investigating university student preferences and beliefs about learning in the web-based context. *Computers & Education*, 50, 1284–1303.
<http://dx.doi.org/10.1016/j.compedu.2006.12.009>
- Zaharudin, R., Nordin, N., & Mohd Yasin, M. (2011). Online ICT-courses integrated for the hearing-impaired individuals' education: A preliminary study from the students' perception. *Informatics Engineering and Informatics Science*, 251, 56–63. <http://dx.doi.org/10.1007/978-3-642-25327-0>



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