The Essential Computer Drawing Labs Facilities and Infrastructure to Achieve Training Quality According to International Standards

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---ABSTRACT--
Educational facilities and infrastructure at any training institute must meet the minimum international standards. This study aims to evaluate the feasibility of the current facilities and infrastructure in the Computer Drawing Labs. The study used quantitative research methods, including observation and documentation. Study results indicate that all aspects of facilities and infrastructure assessed are in the good feasible category, with achievement levels ranging from 70 to 100 percent.   The aspect with the lowest feasibility achievement is the space area at 70%, while the aspect of room furniture, educational media, equipment, and environment quality, achieved feasibility levels of 85%.

I.   Introduction

Quality education and training lead the development of skilled human resources, which in turn can enhance the potential of other resources within a nation. This indicates that education is anticipated to empower individuals to improve their quality of life and serve as a source of inspiration. This study will focus on the Computer Drafter training environment, which includes drawing labs, computer machines, software, media instruments, and furniture. As a vocational training institute, the outcome of various specialties and in particular draftsman needs good management of the institution's facilities and proper infrastructure. It is essential to hold an efficient process that supports vocational training activities.

Fig. 1 - Construction Training Institute (CTI) – PAAET – AL Ahmady City - Kuwait

Educational institutions need quality standards to be followed to optimize facilities and infrastructure. The computer drawing labs are a critical space that must be standardized, to uphold the best education standards.

1. The National Clearinghouse for Educational Facilities (NCEF) provides standards and guidelines for classroom space, it recommends:
1.1. Student's Area: 30-40 square feet (2.8-3.7 sqm) per student for computer labs.
1.2. Instructor's Area: typically, near a projector or large display. This area could range from 50-100 square feet (5-9 sqm).
1.3. Additional Space: extra space for circulation, storage, and other equipment such as printers, plotters, or drafting boards. This may add another 100-200 square feet (9-18 sqm).

2. Ivy Tech Building Standards (Space Standards) which Include 10 general guiding principles and 5 space specific.

In the general guiding principles:

2.1. Value
2.2. Conducive to learning
2.3. Graduate Competency Standards
2.4. Educators and Education Personnel Standards
2.5. Facilities and Infrastructure Standards
2.6. Management Standards
2.7. Financing Standards
2.8. Educational Assessment Standards

Adequate educational facilities and infrastructure can enhance classroom and lab learning activities. Teachers can utilize the facilities for training, and students can be more motivated to engage in lab activities. Within vocational training institutes (PAAET), high-quality educational facilities and infrastructure are essential to support practical learning performance. A feasibility study is required to evaluate the condition of the existing lab facilities, infrastructure, and equipment. The results of the feasibility study guide for schools to improve their educational facilities and infrastructure. The study ensures verification of vocational facilities, infrastructure, and equipment.

Additional education and training requirements that are not included in the NCEF standards to support the design of computer labs:

1. Furniture in the computer labs.
2. Educational Media in the.
3. Computer machine specification to support AutoCAD program.

The study aims to provide information about the feasibility of the computer labs' facilities and infrastructure. The results will serve as a benchmark for the school's development, helping to improve the lab facilities and infrastructure more effectively.

II.   Method

The research study is quantitative and utilizes observation and documentation techniques. The data is then analysed using descriptive statistical methods. The observation method involves observing and recording various processes related to the research subject. During the research process, data is presented in the form of photos. However, the analysed data does not lead to a general conclusion. The study used the observation method to directly assess the condition of the facilities and infrastructure in the Computer Drawing Labs at the Construction Training Institute (CTI). The results were then compared with a questionnaire developed by the researcher based on previously mentioned standards, as well as the standard specifications for computer machines.

The scoring system used in this questionnaire is a rating scale in the form of a checklist with four scoring criteria. The assessment criteria are calculated using the following equation:

Assessment Criteria = (X/Y) × 100%   X = questionnaire real score
                                                Y = questionnaire maximum score

Score	Description	Assessment Criteria %
4	Very Feasible	81 - 100
3	Feasible	61 - 80
2	Less Feasible	31 - 60
1	Not Feasible	0 - 30

Table 1. Research assessment criteria

III. Results and Discussion

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3.1 The Feasibility Level of the Computer Drawing Labs Infrastructure

From the results of the analysis, as shown in (Table 2), it can be seen that the condition of the infrastructure in the Computer Drawing Labs Room at CTI gets an achievement value of feasibility at 60% ("feasible" category) (Table 1).

3.2 The Feasibility Level of the Furniture in the Computer Drawing Labs

From the results of the analysis, as shown in Table 3, it can be seen that the condition of the furniture in the Computer Drawing Labs Room at CTI gets an achievement value of feasibility at 90% ("very feasible" category) (Table 2).

Assessment	Study Outcomes	Marking scale	Actual	Possible Obtain
Student capacity	27 students	24 - 32 students	4	4
Computer Labs area	70 m^2	More than 90 m^2	3	4
Computer Labs width	9 m	8 m - 12 m	3	4
Storage and repair space area	10 m^2	30 m^2 - 50 m^2.	2	4
Ratio of room area per student	3,75 m^2	2m^2 – 2.5 m^2 per student	2	4
Total score earned			14	20

Table 2. Area assessment

Assessment criteria = (14/20) × 100% = 70%
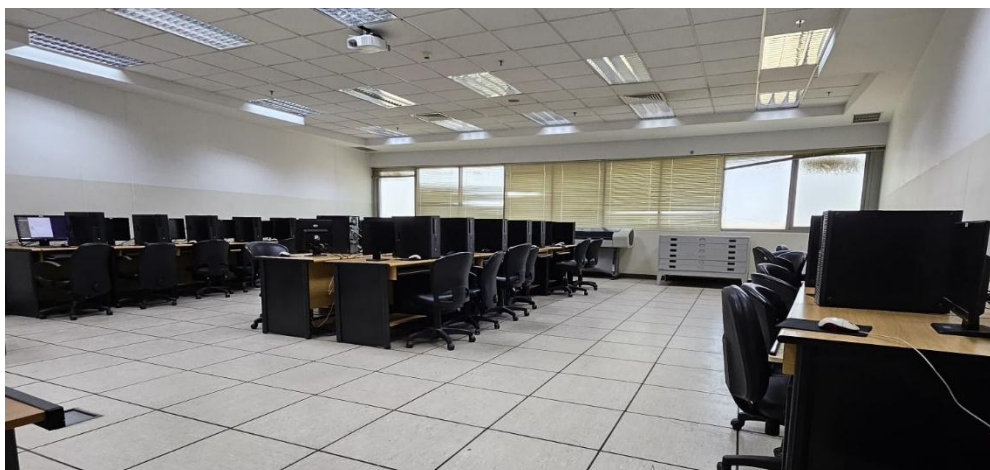
Figure 2 - CAD Lab at CTI – Civil Eng. Dept.

Assessment	Study Outcomes	Marking scale	Actual	Possible Obtain
The number of computer desks per student	27 desks	computer desks and chairs in one computer drawing Labs, between 24 to 32 computer desks that function properly	4	4
Teacher's desk	1 desk	One teacher's desk and chairs in one computer drawing Labs can function properly	4	4
Tool storage cabinet	2 cabinets	The number of tool storage cabinets in one computer drawing Labs room is between 1 to 4 storage cabinets that function properly	2	4
Total score earned			**10**	**20**

Table 3. Furniture assessment

Assessment criteria = (10/20) × 100% = 50%

Assessment	Study Outcomes	Marking scale	Actual	Possible Obtain
Computer machines for a minimum of 32 students to make technical drawings, calculate materials, and cost budgets with a ratio of 1 set/student	32 sets of computer equipment	24 to 32 sets of computer equipment that function properly	4	4
Standard whiteboard, a good position for clear students' visual	1 unit/room	One whiteboard in each computer lab, according to specifications, function properly	4	4
Total score earned			8	8

Table 4. Media assessment results

Assessment criteria = (8/8) × 100% = 100%

3.3 The Feasibility Level of the Educational Media

When analysing Table 4, it is evident that the condition of the educational media in the Computer Drawing Labs at the CTI is excellent, with a value of 100% (categorized as "very feasible").

3.4 The Feasibility Level of the Computer Machine in the Drawing Labs

Assessment	Study Outcomes	Marking scale	Actual	Possible Obtain
Students' computer machines with a minimum processor Specification according to Autodesk (AutoCAD 2025)	processor used is intel CORE i7 vPro 3.4 GHz 64-bit HD storage Windows 10 Enterprise	The computer machine used has not met the minimum standards of specifications	2	4
Minimum memory is 512 MB Specification according to Autodesk (AutoCAD 2025)	memory used is a capacity of 4GB	The computer machine used has met the minimum standards of specifications	4	4
AutoCAD Software that used at least 2020, also it is not recommended to use the latest version	AutoCAD installed on all computers is the 2025 version	The AutoCAD version used on all computers has not met the recommendation	3	4
Printer	Only 1 Colour A3 Kyocera printer	The printers used in labs have met the minimum specification, while the number of printers, has not met the minimum required	2	4
Total score earned			11	16

Table 5. Computer machine assessment

Assessment criteria = (11/16) × 100% = 68.75%

Figure 2

AUTODESK – System Requirements Specs.
(www.https://www.autodesk.com/support/technical/article/caas/sfdcarticles/sfdcarticles/System-requirements)

System requirements for AutoCAD 2025 including Specialized Toolsets (Windows)	
Operating System	*64-bit Microsoft® Windows® 11 and Windows 10 version 1809 or above. See Autodesk's Product Support Lifecycle for support information.*
Processor	*Basic: 2.5-2.9 GHz processor with 8 logical cores (base) ARM Processors are not supported.* *Recommended: 3+ GHz processor (base), 4+ GHz (turbo)*
Memory	*Basic: 8 GB* *Recommended: 32 GB*
Display Resolution	*Conventional Displays:* *1920 x 1080 with True Colour* *High Resolution & 4K Displays:* *Resolutions up to 3840 x 2160 (with "Recommended" display card)*
Display Card	*Basic: 2 GB GPU with 29 GB/s Bandwidth and DirectX 11-compliant* *Recommended: 8 GB GPU with 106 GB/s Bandwidth and DirectX 12-compliant* *DirectX 12 with Feature Level 12_0 is required for Shaded (Fast), Shaded with edges (Fast), and Wireframe (Fast) visual styles. Please be sure to use the latest drivers from the video card manufacturer's website.* *Note: AutoCAD uses your computer's display card for a variety of essential graphics operations including but not limited to view manipulation, line smoothing, and text/line type generation. It is recommended that you have a display card with dedicated VRAM to support these operations at optimal speeds.*
Disk Space	*10.0 GB (suggested SSD)*
Network	*See Autodesk Network License Manager for Windows*
Pointing Device	*MS-Mouse compliant*
.NET Framework	*.NET 8*

3.5 Computer core machine feasibility level as the main equipment in drawing labs
Based on the analysis results in Table 5, it is evident that the condition of the computer hardware supporting drafting and modeling has a moderate score value. The feasibility is 69 out of 100% (categorized as Feasible) (Table 1).

IV.   Conclusion

The results of the study indicate that there are varied achievement feasibility levels, of different aspect of facilities and infrastructure assessed, as follows:

Area assessment is 70%

Furniture assessment is 50%

Media assessment is 100%

Computer machine assessment is 68.75%

Upon deeper analysis of the data, a specific conclusion can be drawn: the minimum feasibility achievement value is 50%, with the Computer Machine for the Drawing Labs scoring 68.75%. This indicates that the quality of the main equipment in the Computer Drawing Labs is relatively low, placing the infrastructure in the "low" feasible category. While the rest of the facilities are rated as "very feasible." The low feasibility of the lab's computer machine could be a weak point in providing high-quality vocational training. This study aims to provide guidelines for schools to ensure proper functionality. The suggested enhancements can help schools and vocational training institutes maintain a positive environment for effective training, teaching, and learning. The primary objective of the study is to optimize the use of current facilities and infrastructure for the benefit of students in the *CAD Drafter* Specialty.

References

[1].   https://hospitalityinsights.ehl.edu/hubfs/Blog-EHL-Insights/Download-resources/School-Facilities-Infrastructures-Guide.pdf
[2].   The Role of Education and Training Institutions in Preparing Competent Human Resources Development - 341567424_The_Role_of_Education_and_Training_Institutions_in_Preparing_Competent_Human_Resources_Development
[3].   www.autodesk.com/support/technical/article/
[4].   National Clearinghouse for Educational Facilities By Tod Schneider https://www.academia.edu/97489265/National_Clearinghouse_for_Educational_Facilities
[5].   https://www.ivytech.edu/about-ivy-tech/college-operations/facilities-capital-planning/ivy-tech-standards/
[6].   An Overview of Quantitative Research Methods - https://www.researchgate.net/publication/373370007_An_Overview_of_Quantitative_Research_Methods