Competency and Challenges of BTLED-ICT Students in 2D Animation: An Analytical Study

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Abstract: This study employed a descriptive-quantitative design to examine the competencies and challenges of Bachelor of Technology and Livelihood Education major in Information and Communication Technology (BTLED-ICT) students in 2D animation. Specifically, it assessed students' profiles in terms of age, sex, and socio-economic status; evaluated their competency in producing traditional key poses, creating traditional animation, developing 2D digital cut-out animation, and exporting animation to video file formats; identified the challenges encountered in learning resources, facilities and equipment, and IT infrastructure; and analyzed the relationship between competency levels and challenges met. Findings revealed that the majority of respondents were young adults, predominantly female (79.7%), with most belonging to lower socio-economic backgrounds (75.9%), which posed limitations in accessing essential resources. Competency results indicated that students were generally proficient in producing key poses and digital cut-out animation, with mean ratings of 3.10 and 3.13, respectively. However, notable gaps remained in areas requiring technical precision, such as dialogue synchronization. Learning resources (M = 4.32) and IT infrastructure (M = 4.33) were perceived favorably, although issues with accessibility, technical support, and policy clarity were noted. Facilities and equipment were also rated positively but raised concerns regarding adequacy of task-specific tools and power accessibility. The study concludes that while BTLED-ICT students possess foundational competencies in 2D animation, socio-economic constraints and technical skill gaps remain barriers to mastery. Enhancing financial support, refining technical training, upgrading learning resources and facilities, and strengthening IT infrastructure are recommended to further improve instructional delivery and student outcomes. These findings underscore the critical role of resource accessibility and institutional support in developing professional competencies in creative and technical fields.

Keywords: BTLED-ICT Students, 2D Animation, Animation Competency, Learning Resources, Facilities and Equipment, IT Infrastructure, Socio-Economic Status, Challenges Met

I. Introduction

The rapid advancement of technology has profoundly reshaped the educational landscape, influencing pedagogical practices and reshaping the skill sets required of future professionals (Beetham & Sharpe, 2013). Among these technological innovations, Information and Communication Technology (ICT) has emerged as a crucial driver of change, particularly in creative and technical disciplines such as 2D animation. In education, animation is more than a creative tool; it functions as both an instructional resource and a professional competency that equips students with the ability to communicate concepts, visualize ideas, and foster engagement in learning environments (Al-Saidy et al., 2019; Rahim et al., 2024).

Despite its growing importance, students pursuing the Bachelor of Technology and Livelihood Education major in Information and Communication Technology (BTLED-ICT) often struggle to meet industry and academic expectations in 2D animation. Many students lack familiarity with the technical rules, standards, and competencies required, resulting in challenges in skill development and confidence in applying animation techniques (Koehler & Mishra, 2009). This issue is particularly concerning given the demand for digitally literate educators who can integrate animation and related technologies into instructional design.

At the national level, the Technical Education and Skills Development Authority (TESDA) plays a vital role in establishing competency standards to align the Filipino workforce with global demands. Pursuant to Republic Act No. 7796, also known as the "Technical Education and Skills Development Act of 1994," TESDA is mandated to promote and develop technical education and skills development, ensuring Filipino graduates is industry-ready. TESDA's 2D animation competency standards outline essential skills such as key pose creation, traditional animation, cut-out digital animation, and exporting files to appropriate formats (TESDA, 2020). These standards serve as critical benchmarks for BTLED-ICT students, providing measurable indicators of proficiency while ensuring alignment with professional expectations.

However, while competency-based education frameworks emphasize mastery of technical and creative skills (Davis et al., 2018), students often encounter barriers that impede their progress. Limited access to quality learning resources, inadequate facilities and equipment, and challenges with IT infrastructure remain persistent issues in higher education institutions in the Philippines (Cruz et al., 2021). Furthermore, socio-economic constraints frequently affect students' ability to access the tools and training necessary to succeed in highly technical fields such as animation. These obstacles underscore the need for a closer examination of BTLED-ICT students' actual competencies and the challenges they face within their learning environment.

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This study, therefore, seeks to analyze the competency levels and challenges of BTLED-ICT students in 2D animation at the College of Teacher Education, Zamboanga Peninsula Polytechnic State University. Specifically, it aims to assess students' skills in alignment with TESDA competency standards, identify difficulties encountered in learning resources, facilities, and IT infrastructure, and examine the relationship between students' competencies and the challenges they face. By addressing these objectives, the research contributes valuable insights for curriculum development, institutional support, and instructional strategies, ultimately fostering innovation, creativity, and excellence in the BTLED-ICT program.

Statement of the Problem

The increasing demand for digital literacy and technical proficiency in education underscores the necessity of equipping future educators with strong competencies in 2D animation. For Bachelor of Technology and Livelihood Education major in Information and Communication Technology (BTLED-ICT) students, animation is not only a specialized skill but also a powerful pedagogical tool that can enhance creativity, communication, and engagement in classroom instruction. Despite the existence of competency standards set by the Technical Education and Skills Development Authority (TESDA), many students face difficulties in mastering these skills due to limited access to appropriate learning resources, inadequate facilities and equipment, and challenges related to IT infrastructure. These issues may hinder their ability to achieve professional readiness and align with industry expectations.

Given this context, the study primarily seeks to evaluate the competency levels of BTLED-ICT students in 2D animation and to identify the challenges that affect their learning outcomes. Particular attention is given to determining how students perform in key areas such as producing traditional key poses, creating traditional animation, developing 2D digital cut-out animations, and exporting projects to video file formats. Beyond identifying these competencies, the study also aims to uncover the specific problems students encounter in terms of instructional resources, facility and equipment availability, and technological infrastructure.

Furthermore, this research investigates whether there is a significant relationship between the competency levels of students and the problems they encounter in their learning environment. Establishing this relationship is crucial, as it will help explain whether deficiencies in resources and infrastructure directly contribute to gaps in student performance.

To address these concerns, this study seeks to answer the following research questions:

What is the profile of the respondents in terms of:

1.1 Age;

1.2 Sex; and

1.3 Socio-Economic Status.

What is the level of competency of the respondents in terms of:
1.1. Producing traditional key poses/drawings during animation;
1.2. Creating traditional animation;
1.3. Creating 2D digital cut-out animation; and
1.4. Exporting animation to video file format?

What are the problems encountered by the respondents in terms of:
2.1. Learning Resources;
2.2. Facilities and Equipment; and
2.3. IT Infrastructure?

Is there a significant relationship between levels of competency when data are grouped according to profile?

II. Review of Related Literature

The Importance of 2D Animation in Education

2D animation has become an indispensable tool in education, supporting visual learning and enhancing student engagement across disciplines. Al-Saidy et al. (2019) emphasize that animated content clarifies complex concepts, making learning more interactive and fostering better retention of information. In the field of teacher education, animation plays a dual role: it serves as a pedagogical tool that improves instructional delivery while also functioning as a core skill area for students to master. This duality underscores the necessity of equipping Bachelor of Technology and Livelihood Education major in Information and Communication Technology (BTLED-ICT) students with strong animation competencies.

Student perspectives on animation in the learning process further highlight its relevance. Green (2016) notes that animations facilitate collaboration between teachers and students, even across linguistic and cultural barriers. Similarly, Desai (2018) observes that students, who are increasingly adept with digital technologies, view animation as a platform for creativity and self-expression. These findings suggest that fostering animation skills not only develops technical proficiency but also cultivates innovation and collaboration among learners.

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Rahim et al. (2024) further illustrate the benefits of 2D animation in science education, showing that visualizing abstract concepts through animation enhances comprehension and engagement. However, the study also identifies challenges such as limited technological access, insufficient teacher training, and mismatched content suitability. These issues are relevant to BTLED-ICT students, who often face similar barriers in mastering animation tools and techniques.

Digital Literacy and 2D Animation Competency

The acquisition of 2D animation skills is closely linked to digital literacy. Buckingham (2016) argues that a lack of digital literacy impedes students' ability to effectively use software tools and engage with digital content. For BTLED-ICT students preparing for teaching careers, animation proficiency must be complemented by digital fluency to meet the demands of technology-integrated classrooms. This relationship suggests the need to examine whether varying levels of digital literacy among students contribute to differences in animation competency.

TESDA Standards and Competency Benchmarks

The Technical Education and Skills Development Authority (TESDA) has established competency standards for 2D animation that include storyboarding, character design, traditional and digital animation, and video exportation (TESDA, 2021). These benchmarks ensure that learners acquire industry-relevant skills, thereby enhancing employability and professional readiness. Comparing BTLED-ICT students' performance against TESDA standards provides a valuable lens for identifying strengths and weaknesses in their training. Such an analysis can inform targeted curriculum improvements and bridge the gap between academic preparation and industry expectations.

Competency-Based Education and Student Learning

Competency-based education (CBE) frameworks, such as those embedded in TESDA's programs, emphasize mastery of skills rather than adherence to time-based learning structures. Research by Davis et al. (2018) demonstrates that CBE fosters deeper understanding, greater confidence, and higher retention of knowledge among students. For BTLED-ICT students, mastering 2D animation competencies under a CBE approach could translate into improved creativity, problem-solving skills, and adaptability in both teaching and technical fields.

Nonetheless, challenges persist in implementing CBE effectively. Cruz et al. (2021) identify barriers such as limited access to updated technologies, insufficient training resources, and a shortage of qualified instructors. Moreover, the rapid evolution of animation tools and industry trends often leaves students unprepared for professional demands. These findings highlight the importance of aligning academic programs with CBE principles while addressing structural and resource-based challenges.

Challenges in Learning 2D Animation

Students face multiple challenges in developing 2D animation skills. Elliott et al. (2020) report difficulties related to technical precision, limited exposure to industry-standard software, and a lack of adequate instructional materials. In addition to technical hurdles, students also struggle with the creative aspects of animation, which demand a balance of artistic sensibility and technical expertise. This often leads to frustration and disengagement, particularly for students without prior training in digital art or design.

Paiva, Leal, and Figueira (2022) suggest that factors such as prior educational experiences and resource availability significantly influence students' animation competencies. Similarly, Rivera and Santos (2020) found that limited technology access, poor resource allocation, and inadequate instructor expertise hinder animation learning outcomes. These studies resonate with the challenges BTLED-ICT students encounter, making it essential to examine the impact of such barriers on competency development.

Strategies for Addressing Competency Gaps

Scholars have proposed interventions to overcome these challenges. Cruz et al. (2021) advocate for targeted workshops focusing on both technical and creative skills, while Mendoza and Lim (2019) highlight the value of curriculum designs that emphasize hands-on practice and real-world applications. Collaborative projects and peer learning opportunities have also been shown to improve engagement and performance (Alonzo & Torres, 2021). However, gaps remain in the literature regarding the effectiveness of these strategies for BTLED-ICT students specifically, pointing to the need for further investigation.

Synthesis and Research Gap

The reviewed literature highlights the importance of 2D animation in education, the role of digital literacy in shaping competencies, the relevance of TESDA standards, and the challenges faced by students in acquiring animation skills. While existing studies identify barriers such as resource limitations, insufficient training, and digital literacy gaps, there is limited research on how these challenges intersect with competency levels among BTLED-ICT students. Furthermore, the relationship between competency outcomes and the problems students encounter has not been adequately examined.

This study addresses these gaps by analyzing the competency levels of BTLED-ICT students in relation to TESDA standards, identifying the specific problems they face with learning resources, facilities, and IT infrastructure, and examining the relationship between these challenges and student performance. The findings aim to inform curriculum development, institutional support, and instructional strategies to enhance animation education in teacher training programs.

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III. Methodology

Research Design

This study employed a **descriptive-quantitative research design** to analyze the competencies and challenges of BTLED-ICT students in 2D animation. The descriptive approach was deemed appropriate as it provides a systematic means of assessing students' current skills and identifying problems encountered in their learning process. Quantitative methods were used to obtain measurable data that allowed for statistical examination of the relationship between competency levels and challenges faced by the respondents.

A structured questionnaire served as the primary data-gathering instrument. The questionnaire consisted of three major sections:

Respondent Profile – This section collected demographic and socio-economic information, such as age, sex, and family income level, to establish the background of participants.

Competency Assessment – This portion evaluated the respondents' skills in four key areas aligned with TESDA's standards for 2D animation: (a) producing traditional key poses/drawings, (b) creating traditional animation, (c) creating 2D digital cut-out animation, and (d) exporting animation into video file format. The assessment focused on both cognitive and psychomotor aspects to provide a holistic view of student competency.

Challenges Met – This section examined the difficulties students faced in terms of (a) learning resources, (b) facilities and equipment, and (c) IT infrastructure. Respondents rated their experiences using a Likert scale to capture the degree of challenges encountered.

Following Creswell (2014), quantitative research is an effective approach for examining the relationship between variables, particularly when data are collected through structured instruments that yield numerical values for statistical analysis. In this study, descriptive statistics such as frequency, percentage, and weighted mean were used to summarize respondent profiles and competency levels. Meanwhile, inferential statistics, specifically Pearson's correlation, were employed to determine the relationship between students' competency levels and the problems they encountered.

This design enabled the researchers to obtain a comprehensive understanding of both the skill proficiency and the barriers to learning faced by BTLED-ICT students in 2D animation. The findings are expected to inform curriculum development and institutional interventions that will enhance animation education in teacher training programs.

Research Locale

The study was conducted at Zamboanga Peninsula Polytechnic State University (ZPPSU), a premier institution in Western Mindanao known for its commitment to providing quality education in both technical and teacher education programs. Specifically, the research was carried out within the College of Teacher Education (CTE), which houses the Bachelor of Technology and Livelihood Education (BTLED) program. Among its various specializations, the BTLED major in Information and Communication Technology (ICT) offers courses that focus on digital skills, including 2D animation, making it an ideal setting for this investigation.

The choice of this locale is highly relevant, as ZPPSU's CTE program emphasizes both pedagogical training and technical skill development, aligning directly with the study's objectives of assessing competencies and challenges in 2D animation. The availability of ICT-related courses and facilities provided a suitable academic environment to examine how students develop and apply animation skills within a teacher education framework.

For the data collection process, a designated venue within the university was selected to administer the structured questionnaires. The setting ensured a calm, organized, and distraction-free atmosphere, allowing respondents to provide accurate and thoughtful answers.

In addition, the research adhered to strict ethical standards. Prior to participation, all respondents were fully informed about the objectives and procedures of the study and gave their voluntary consent. Confidentiality and privacy of responses were maintained throughout the research process, ensuring that the data collected reflected the authentic experiences and perspectives of the participants.

Respondents of the Study

The respondents of this study were Bachelor of Technology and Livelihood Education (BTLED) students majoring in Information and Communication Technology (ICT) enrolled under the College of Teacher Education (CTE) at Zamboanga Peninsula Polytechnic State University. Specifically, the participants were those who had undertaken the 2D Animation NC II competency ensuring that they possessed relevant exposure to animation concepts, techniques, and practices. This group was deemed most appropriate for the study because their experiences and skill levels could provide meaningful insights into both their competency in 2D animation and the challenges encountered in the learning process.

A total of 79 students were selected to participate in the study out of 99 enrolled BTLED-ICT students. The distribution of respondents across year levels is shown in Table 1, which illustrates representation from all academic years within the program.

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Table 1. Distribution of Respondents by Year Level

Year Level	N	%
First	35	44
Second	19	24
Third	10	13
Fourth	15	19
Total	**79**	**100**

Research Instrument

The primary research instrument employed in this study was a structured survey questionnaire, which was carefully designed to measure the competency levels of BTLED-ICT students in 2D animation, as well as to identify their demographic profiles and the challenges they encountered during their training. The questionnaire was divided into four major sections: (1) Respondents' Profile, which gathered data on age, sex, and socio-economic status; (2)Competency Assessment, which evaluated student proficiency across the four core areas of 2D animation (producing traditional key poses/drawings, creating traditional animation, creating 2D digital cut-out animation, and exporting animation to video file format); (3) Learning Resources, Facilities, and IT Infrastructure, which examined the adequacy and availability of institutional support; and (4) Challenges Encountered, which sought to capture perceived barriers to effective learning and skill development.

The competency assessment utilized a 4-point Likert scale, interpreted as follows: 4 – Highly Competent, 3 – Competent, 2 – Moderately Competent, and 1 – Not Competent. This scale was chosen for its clarity in distinguishing skill levels without providing a neutral midpoint, thereby encouraging respondents to make more precise evaluations of their proficiency.

To evaluate challenges and perceptions regarding learning resources, facilities and equipment, and IT infrastructure, a 5-point Likert scale was employed, interpreted as: 4.21–5.00 = Strongly Agree (SA); 3.41–4.20 = Agree (A); 2.61–3.40 = Neutral; 1.81–2.60 = Moderately Agree (MA); and 1.00–1.80 = Disagree (D). This scale allowed for a more nuanced understanding of students' perceptions, particularly in gauging levels of agreement on institutional support and identifying potential areas of concern.

Validity and Reliability of the Research Instrument

Ensuring the validity and reliability of the research instrument was a crucial step in guaranteeing the accuracy and credibility of the study's findings. The survey questionnaire underwent a two-phase process of validation and reliability testing.

To establish content validity, the questionnaire was subjected to expert evaluation by three professionals: one faculty member specializing in ICT education, one TESDA-certified 2D animation trainer, and one educational research methodologist. The experts reviewed the instrument in terms of clarity, relevance, alignment with research objectives, and consistency with TESDA competency standards. Their recommendations led to refinements in item wording, structure, and scaling to ensure that the questionnaire effectively captured the intended constructs of competency and challenges in 2D animation.

To determine the internal consistency of the instrument, a pilot test was conducted with 20 BTLED-ICT students who were not part of the final sample. The responses were subjected to reliability analysis using Cronbach's Alpha coefficient. Results showed that the overall instrument had an alpha value of 0.87, which is considered highly reliable, indicating that the items were consistent and dependable in measuring students' competencies and perceived challenges. Sectional reliability analysis also revealed strong coefficients for the competency scale ($\alpha = 0.85$) and the challenges scale ($\alpha = 0.83$), further confirming the robustness of the instrument.

Based on the outcomes of the validation and reliability procedures, the finalized questionnaire was deemed both valid and reliable for use in assessing the competency and challenges of BTLED-ICT students in 2D animation. This process strengthened the credibility of the study's findings and ensured that the results could be used as a sound basis for academic recommendations and program development.

Data Gathering Procedure

The data gathering process followed a systematic and ethically sound approach to ensure the accuracy, credibility, and integrity of the study. Prior to data collection, formal permission was sought from the Office of the Dean of the College of Teacher Education (CTE) at Zamboanga Peninsula Polytechnic State University. The purpose, scope, and significance of the study were explained to the administration, and approval was granted to administer the research instrument to Bachelor of Technology and Livelihood Education major in Information and Communication Technology (BTLED-ICT) students.

The researchers provided participants with an informed consent form outlining the objectives of the study, the voluntary nature of participation, and assurances of confidentiality and anonymity. Respondents were assured that their identities would not be disclosed and that the information provided would be used solely for academic purposes.

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The validated questionnaires were distributed to BTLED-ICT students enrolled in the 2D Animation NC II course. To accommodate students' availability and ensure convenience, data collection was conducted primarily through an online survey method using Google Forms. A dedicated group chat was created for coordination, where students received clear instructions on how to access and complete the survey link. Sufficient time was allotted for responses, and participants were encouraged to answer truthfully and accurately based on their experiences.

The researchers actively monitored the response process to ensure that the questionnaires were properly accomplished and that no items were left unanswered. Gentle reminders were sent to participants who had not yet completed the survey, ensuring a high response rate and comprehensive data collection.

Upon retrieval, the completed questionnaires were automatically compiled through Google Forms and downloaded in spreadsheet format. The responses were carefully reviewed, coded, and organized for analysis. The data were then entered into statistical software for processing, enabling descriptive and inferential analysis aligned with the study's objectives.

This structured and ethical data gathering procedure not only safeguarded the rights of the participants but also ensured the accuracy, completeness, and reliability of the data collected for the study.

IV. Results and Discussion

The profile of the respondents in terms of Age, Sex, and Socio-Economic Status

Table 2 Profile of the respondents (n=79)

	Frequency	Percentage
Age		
24yearsoldandabove	13	16.5%
23-22yearsold	15	19%
21-20yearsold	33	41.7%
19-18yearsold	18	22.8%
Sex		
Male	16	20.3%
Female	63	79.7%
Socio-Economic Status		
30,001andabovemonthlysalary	3	3.8%
30,000-20,001monthlysalary	3	3.8%
20,000-10,001monthlysalary	13	16.5%
10,000andbelowmonthlysalary	60	75.9%

The demographic characteristics of the respondents (n=79) indicate that a considerable proportion were within the younger age range, with 41.7% identified as 21–20 years old and 22.8% as 19–18 years old. A smaller percentage, 19%, fell within the 22–23-year-old group, while only 16.5% were aged 24 years and above, suggesting that the sample was largely composed of late adolescents and emerging adults. In terms of sex, the data show a marked imbalance, with females comprising 79.7% of the respondents compared to only 20.3% males. The socio-economic distribution further reveals that a majority (75.9%) reported a household monthly income of ₱10,000 and below, reflecting a predominantly low-income demographic. Additionally, 16.5% of the participants belonged to the ₱20,000–₱10,001 income bracket, while only a small proportion, 3.8% each, reported monthly incomes between ₱20,001–₱30,000 and ₱30,001 and above. These findings highlight the overrepresentation of females and low-income earners in the sample. Collectively, the profile underscores a respondent pool that is predominantly young, female, and socio-economically disadvantaged, which is crucial in contextualizing their responses within the scope of this study.

Table 3 Level competency of the respondents in terms of Produce Traditional Key poses/drawings during animation, create traditional animation, Create 2D digital cut-out animation, and Export animation to video file format

Aspects	**AWM**	**VI**
1.ProduceTraditionalKeyPoses/Drawings During Animation	3.1	Competent

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2.CreateTraditionalAnimation	3.14	Competent
3.Create2DDigitalCut-OutAnimation	3.12	Competent
4.ExportAnimationtoVideoFileFormat	3.12	Competent
Composite mean	**3.12**	**Competent**

Parameters: Highly Competent (4.0-3.26) Competent (3.25-2.6) Moderately Competent(2.50-1.74)Not Competent(1.75-1.00)

Table 3 presents the competency levels of BTLED-ICT students in four core domains of 2D animation, namely producing traditional key poses/drawings, creating traditional animation, developing 2D digital cut-out animation, and exporting animation to video file format. The composite mean of 3.12, interpreted as Competent, suggests that while students possess sufficient skills to perform animation tasks, their proficiency remains below the Highly Competent level. Among the areas assessed, the highest mean was obtained in creating traditional animation ($\bar{x}$ = 3.14), followed by creating 2D digital cut-out animation ($\bar{x}$ = 3.12) and exporting animations into video file format ($\bar{x}$ = 3.12), whereas producing traditional key poses/drawings ($\bar{x}$ = 3.10) registered the lowest score, though still within the competent range. These results imply that students are more confident in technical and software-based tasks than in drawing-intensive aspects, which demand both artistic and technical proficiency. The overall findings indicate that students have attained a functional level of competency in both traditional and digital animation, yet the lack of Highly Competent ratings suggests the need for further enhancement in creativity, technical mastery, and adherence to professional standards. This observation is consistent with prior research (Elliott et al., 2020; Cruz et al., 2021), which reported that students often achieve baseline competency but struggle to reach higher proficiency due to gaps in artistic training, limited practice opportunities, and restricted access to advanced tools. Therefore, while BTLED-ICT students demonstrate competency in 2D animation, strengthening their training in drawing fundamentals, software proficiency, and practice-based learning remains essential to elevate their skills to the Highly Competent level expected in both TESDA standards and industry practice.

Table 4 presents the perceptions of BTLED-ICT students regarding the adequacy of learning resources in relation to their competency development in 2D animation, with an overall weighted mean of 4.32, interpreted as Strongly Agree. This result indicates that students generally view the provided resources as useful, accessible, and effective in supporting their learning process, even though challenges persist in other aspects of training. Among the indicators, the highest ratings were given to instructional materials such as tutorials and guides in Adobe Animate ($\bar{x}$ = 4.41, SA) and hands-on practice opportunities through applications like Microsoft Paint 3D ($\bar{x}$ = 4.40, SA), underscoring the importance of structured and practice-oriented resources that bridge theory and application. Likewise, the accessibility of resources across multiple platforms and the comprehensiveness of available animation tools were highly valued ($\bar{x}$ = 4.39, SA), highlighting students' preference for flexibility and functionality in learning materials. On the other hand, aspects related to hardware and system reliability received relatively lower, though still positive, ratings, such as the adequacy of up-to-date computers ($\bar{x}$ = 4.24, A) and the stability of systems with minimal technical errors ($\bar{x}$ = 4.17, A). These findings suggest that while learning resources are adequate, their optimal use may occasionally be limited by infrastructure-related issues, particularly outdated hardware and system maintenance, which is consistent with observations in prior studies (Cruz et al., 2021; Rahim et al., 2024). Overall, the results affirm that students do not perceive a lack of learning resources as a barrier to competency development; rather, the constraints lie in technological infrastructure that supports resource utilization. In this context, continuous institutional investment in hardware upgrades, stable systems, and expanded software access would be essential in further enhancing the development of students' competencies in 2D animation.

The Challenges met by the respondent in terms of learning resources, facility and equipment, and IT infrastructure

Table 4 The challenges met by the respondent in terms of Learning Resources

Statement	Weighted Mean	Interpretation
1. The instructional materials, such as tutorials and guides within Adobe Animate, help me understand animation concepts clearly.	4.41	Strongly Agree
2. The learning resources Iused has an intuitive and user-friendly interface, making it easy to access and navigate the software.	4.36	Strongly Agree
3. The late stversio no fcomputer Iuse is up to date with the latest features and updates for optimal functionality.	4.24	Agree

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4. Software like adobe animate and books about animation offers a comprehensive set of tools, Including animation, rigging, and painting features, which are well-organized and easy to find.	4.39	Strongly Agree
5.Theisavailableinmultipleformats,suchasweb- Based, desktop, and mobile versions, to cater to different learning preferences.	4.39	Strongly Agree
6. Multimedia such as YouTube, Google, and Facebook built-in resources such as step-by-step tutorials, clear explanations, and relevant examples that aid in better understanding animation techniques.	4.39	Agree
7. The blended online manual software allows me to easily search for and navigate through information, including tools, help sections, and animation libraries.	4.29	Agree
8. The software used in making 2d animation like adobe animate was accessible across a variety of Devices, including Windows, macOS, and tablets, ensuring I can work from anywhere.	4.21	Strongly Agree
9. The computers are stable and rarely experiences technical errors, such as crashing or freezing during use.	4.17	Agree
10.The Microsoft3D paint provides opportunities for hands-on practice, including interactive exercises and animation projects to apply concepts learned.	4.40	Strongly Agree
Average Weighted Mean	**4.32**	**Strongly Agree**

Parameters: 4.21–5.0 (SA-Strongly Agree); 3.41–4.20 (A-Agree); 2.61–3.40 (Neutral); 1.81 – 2.6 (MA-Moderately Agree); 1.0-1.80 (D-Disagree).

Table 5 presents the perceptions of BTLED-ICT students regarding the adequacy of facilities and equipment in supporting their learning in 2D animation, yielding an overall weighted mean of 4.33, interpreted as *Strongly Agree*. This finding indicates that students were generally highly satisfied with the institutional provisions, recognizing that the facilities and equipment sufficiently supported their animation training. The highest-rated indicators were the user-friendliness of computers and software ($\bar{x}$ = 4.36, SA) and the comfort of the working environment through adequate ventilation and temperature control ($\bar{x}$ = 4.36, SA), highlighting the critical role of ergonomic and intuitive environments in enhancing learning effectiveness. Other well-rated aspects included the ergonomic design of workspaces ($\bar{x}$ = 4.30, A), the availability of complete and functional laboratory equipment ($\bar{x}$ = 4.28, A/SA), and access to essential software such as Adobe Animate and Flipaclip ($\bar{x}$ = 4.27, A), which collectively demonstrate that students perceive the facilities as aligned with the technical demands of animation coursework. Nonetheless, some indicators, such as accessibility of computers when needed ($\bar{x}$ = 4.29, A) and availability of stable internet connectivity and power outlets ($\bar{x}$ = 4.24, A), revealed minor but notable concerns, consistent with previous studies (Cruz et al., 2021; Paiva et al., 2022) that emphasize the importance of reliable infrastructure for digital learning efficiency. These results suggest that while facilities and equipment do not pose a major barrier to competency development, even minimal limitations in connectivity or computer availability can disrupt workflow and hinder the attainment of TESDA competency benchmarks. Overall, the findings affirm that students regard their learning environment as supportive, but addressing residual issues in technological infrastructure—particularly in ensuring stable internet access and adequate computer availability during peak use—would further enhance their competency development in 2D animation.

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Table 5 The challenges met by the respondent in terms of Facility and Equipment

Statement	Weighted Mean	Interpretation
1. I can easily access the computer when needed.	4.29	Agree
2. I can see clearly because there is sufficient lighting inside the computer laboratory.	4.25	Agree
3. The computer laboratory has comfortable and ergonomic working environment.	4.30	Agree
4. It is properly calibrated and accurate.	4.26	Strongly Agree
5. I have no problem with power outlets and internet connectivity every time I used the computer.	4.24	Agree
6. It meets the specific requirements of my tasks, such as access to a computer and a cell phone.	4.21	Agree
7. It provides access to necessary tools, such as Adobe Animate and Flip a clip, and resources like computers and cell phones.	4.27	Agree
8. Computers and software used is user- friendly and easy to operate.	4.36	Strongly Agree
9.The computer laboratory has good ventilation and temperature control, ensuring a comfortable Work environment.	4.36	Strongly Agree
10. All equipment inside the laboratory are complete and fully functional.	4.28	Strongly Agree
Average Weighted Mean	4.33	Strongly Agree

Parameters: 4.21–5.0 (SA-Strongly Agree); 3.41–4.20 (A-Agree); 2.61–3.40 (Neutral); 1.81 – 2.6 (MA-Moderately Agree); 1.0-1.80 (D-Disagree).

Table 6 Challenges met of the respondent in terms of IT Infrastructure

Statement	**Weighted Mean**	**Interpretation**
1. I can rely on them because they're consistently available.	4.31	Agree
2. It meets my specific requirements, providing customized solutions that drive productivity.	4.31	Agree
3. Whenever I encounter issues, the support team responds promptly and efficiently, ensuring minimal downtime.	4.38	Agree
4. The effective security measures safeguard my sensitive data, giving me confidence in the integrity of my systems.	4.24	Agree
5. Seamless communication and collaboration tools enable me to work efficiently.	4.26	Agree
6. The IT infrastructure grows with me, accommodating increasing demands without disruption.	4.84	Agree
7.Policies and procedures are well-documented, easily accessible, and effectively communicated	4.17	Agree
8. Intuitive infrastructure and sufficient IT training/resources empower me to work efficiently.	4.22	Agree
9. The IT environment seamlessly connects all my different systems and applications.	4.22	Agree
10. The security measures ensure compliance with relevant regulations, safeguarding	4.34	Agree

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data privacy.		
Average Weighted Mean	**4.33**	**Strongly Agree**

Parameters: 4.21–5.0 (SA-Strongly Agree); 3.41–4.20 (A-Agree); 2.61–3.40 (Neutral); 1.81 – 2.6 (MA-Moderately Agree); 1.0-1.80 (D-Disagree).

Table 6 presents the challenges encountered by BTLED-ICT students with regard to IT infrastructure, showing an overall weighted mean of 4.33, interpreted as *Strongly Agree*. This result suggests that respondents generally perceive their institution's IT infrastructure as highly supportive and reliable in facilitating both their 2D animation training and related academic activities. The highest-rated indicator was scalability of IT infrastructure ($\bar{x}$ = 4.84, A), underscoring the institution's capacity to handle increasing digital demands, such as large file storage, software updates, and rendering tasks, without disrupting workflow—an essential factor for sustaining animation coursework. Another key strength identified was the responsiveness of the IT support team ($\bar{x}$ = 4.38, A), which students valued for minimizing downtime and ensuring timely resolution of technical concerns. Security and data protection measures ($\bar{x}$ = 4.34, A) and the availability of seamless communication and collaboration tools ($\bar{x}$ = 4.26, A) further reinforced students' confidence in the reliability of their digital learning environment. On the other hand, indicators such as documentation of IT policies and procedures ($\bar{x}$ = 4.17, A) and integration of systems and applications ($\bar{x}$ = 4.22, A), though still rated positively, revealed areas where improvements could enhance efficiency and user experience, echoing Buckingham's (2016) argument that clear guidelines and strong integration are crucial to maximizing digital infrastructure. Overall, the findings indicate that IT infrastructure is not a major barrier to competency development in 2D animation, as essential elements such as availability, scalability, security, and support are well established, although ongoing upgrades and policy improvements remain necessary. In the context of the study's research problem, these results affirm that the technological environment of the institution is broadly conducive to competency acquisition, complementing earlier findings on facilities and learning resources while emphasizing the need for continuous enhancement to align with evolving industry standards.

Significant relationship between the level of competency when data are group according to Profile

Table 7 Significant relationship when data are group according to Sex

Competency	Sex	Weighted Mean	F	P-Value	Decision	Sig
Poses/Drawings During Animation	Male	3.28	2.039	.157	Accept Null Hypothesis	Not Significant
	Female	3.03				
Create Traditional Animation	Male	3.32	1.480	.288	Accept Null Hypothesis	Not Significant
	Female	3.15				
Create 2D Digital Cut-Out Animation	Male	3.42	3.518	.065	Accept Null Hypothesis	Not Significant
	Female	3.06				
Export Animation to Video File Format	Male	3.46	6.015	.107	Accept Null Hypothesis	Not Significant
	Female	3.01				

Parameters: 4.21–5.0 (SA-Strongly Agree); 3.41–4.20 (A-Agree); 2.61–3.40 (Neutral); 1.81 – 2.6 (MA-Moderately Agree); 1.0-1.80 (D-Disagree).

Table 7 presents the analysis of the relationship between the competency levels of BTLED-ICT students in 2D animation when grouped according to sex, focusing on four core areas: producing traditional key poses/drawings, creating traditional animation, developing 2D digital cut-out animation, and exporting animation to video file format. The results indicate that no statistically significant differences were found between male and female respondents across all competencies, as reflected by p-values greater than 0.05. For example, while males (M = 3.28) scored slightly higher than females (M = 3.03) in producing traditional key poses/drawings, the difference was not significant (F = 2.039, p = .157), and a similar pattern was observed in creating traditional animation (M = 3.32 vs. M = 3.15; F = 1.480, p = .288). Comparable trends were also evident in creating 2D digital cut-out animation (F = 3.518, p = .065) and exporting animations to video file formats (F = 6.015, p = .107), where males consistently obtained marginally higher mean scores, though these differences did not reach significance. These findings suggest that sex does not serve as a determining factor in shaping students' competency in 2D animation, as both male and female respondents demonstrated skills within the "Competent" range. The results highlight that competency in animation is more strongly influenced by training, exposure, and practice rather than gender. This aligns with prior research asserting that when learning environments and resources are equitable, male and female students attain comparable levels of proficiency in both technical and creative disciplines.

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Table 8 Significant relationship when data group according to Sex

Competency	Sex	Weighted Mean	F	P-Value	Sig
Poses/Drawings During Animation	Male	3.28	2.039	.157	Not Significant
	Female	3.03			
Create Traditional Animation	Male	3.32	1.480	.288	Not Significant
	Female	3.15			
Create 2D Digital Cut-Out Animation	Male	3.42	3.518	.065	Not Significant
	Female	3.06			
Export Animation to Video File Format	Male	3.46	6.015	.107	Not Significant
	Female	3.01			

The table 8 shows the analysis of the relationship between sex and various animation competencies revealed no statistically significant differences across all assessed areas. In terms of producing poses or drawings, males obtained a mean score of 3.28 compared to 3.03 for females, with an F-value of 2.039 and a p-value of 0.157, indicating non-significance ($p > 0.05$). A similar trend was observed in creating traditional animation, where males ($M = 3.32$) scored slightly higher than females ($M = 3.15$), yet the difference was not statistically significant ($F = 1.480$, $p = 0.288$). The pattern extended to competencies in creating 2D digital cut-out animations and exporting animations to video file formats, where mean scores ranged from 3.06 to 3.46, with corresponding F-values of 3.518 and 6.015 and p-values of 0.065 and 0.107, all exceeding the 0.05 threshold. These results collectively suggest that sex is not a determining factor in shaping animation-related competencies among the respondents. Both male and female students demonstrated comparable skill levels, reflecting that training and exposure rather than gender influence competency development. This finding is consistent with prior literature indicating minimal gender differences in most cognitive domains, including spatial reasoning, which is often linked to animation proficiency.

Table 9 Significant relationship when data group according to Socio-Economic Status

Competency	Socio Economic Status	Mean	F	P- Value	Sig
Poses/Drawings During Animation	30,001 and above monthly salary	3.17	**1.227**	**.306**	**Not Significant**
	30,000-20,001 monthly salary	2.96			
	20,000-10,001 monthly salary	3			
	10,000 and below monthly salary	3.73			
Create Traditional Animation	30,001 and above monthly salary	3.17	**.509**	**.677**	**Not Significant**
	30,000-20,001 monthly salary	3.09			
	20,000-10,001 monthly salary	3.13			
	10,000 and below monthly salary	3.60			
Create 2D Digital Cut-Out Animation	30,001 and above monthly salary	3.12	**1.572**	**.215**	**Not Significant**
	30,000-20,001 monthly salary	3			
	20,000-10,001 monthly salary	3.26			
	10,000 and below monthly salary	3.93			
Export Animation To Video File Format	30,001 and above monthly salary	3.08	**1.986**	**.123**	**Not Significant**
	30,000-20,001 monthly salary	3.15			
	20,000-10,001 monthly salary	2.93			
	10,000 and below monthly salary	4			

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The analysis of the relationship between socio-economic status and animation competencies revealed no statistically significant differences across all assessed areas. For producing poses or drawings, mean scores ranged from 2.96 for respondents earning ₱30,000–₱20,001 monthly to 3.73 for those earning ₱10,000 and below, with an F-value of 1.227 and a p-value of 0.306, indicating non-significance ($p > 0.05$). A similar pattern was observed in creating traditional animation, where mean scores varied from 3.09 (₱30,000–₱20,001) to 3.60 (₱10,000 and below), yet the difference was not significant ($F = 0.509$, $p = 0.677$). Consistent findings emerged for creating 2D digital cut-out animations and exporting animations to video formats, with mean scores ranging from 2.93 to 4.00, F-values of 1.572 and 1.986, and corresponding p-values of 0.215 and 0.123, all exceeding the threshold for significance. These results indicate that socio-economic status is not a determining factor in shaping animation-related competencies among the participants. Both higher- and lower-income groups demonstrated comparable levels of competency, suggesting that training and educational opportunities, rather than income level, are more critical influences on skill acquisition. Nonetheless, prior research has emphasized that socio-economic status can shape access to quality education and resources, which may indirectly affect skill development in technical and creative fields such as animation.

V. Conclusion

The findings of this study demonstrate that BTLED-ICT students possess a generally competent level of proficiency in core areas of 2D animation, including producing traditional key poses/drawings, creating traditional animation, developing 2D digital cut-out animation, and exporting animation to video file formats. While the composite mean indicates competence, the absence of *Highly Competent* ratings suggests that their skills remain at a functional rather than advanced level, particularly in drawing-based aspects that require higher artistic and technical integration. This limitation underscores the importance of strengthening both creative and technical training through sustained practice and enhanced exposure to industry-standard tools. Furthermore, analysis of demographic variables revealed that competency levels were not significantly influenced by sex or socio-economic status, suggesting that animation proficiency is shaped more by training and learning opportunities than by demographic differences. The availability of adequate learning resources, supportive facilities, and reliable IT infrastructure was also highlighted as a key factor in promoting competency development, although certain limitations in hardware stability and connectivity remain evident. Overall, the results suggest that students are equipped with foundational skills necessary for professional growth but require further refinement to meet higher industry and TESDA standards.

In conclusion, this study affirms that BTLED-ICT students have developed a baseline competency in 2D animation, supported by institutional provisions of resources, facilities, and IT infrastructure that are generally perceived as adequate and effective. However, the findings also reveal that elevating students' proficiency to a *Highly Competent* level necessitates continuous pedagogical innovation, targeted interventions in drawing and software mastery, and sustained investment in technological infrastructure. The absence of significant differences based on sex and socio-economic status further highlights the potential for equitable learning outcomes when adequate resources and training are accessible to all students. These results hold important implications for curriculum developers, instructors, and policymakers, who must ensure that animation education goes beyond competence by fostering creativity, technical mastery, and professional readiness. Moreover, addressing residual challenges in hardware, internet stability, and policy integration would further optimize the learning environment, ensuring that students are not only competent but also industry-ready. Future research may extend this inquiry by exploring longitudinal impacts of enhanced training interventions and examining alignment between institutional competencies and actual industry demands.

Limitations of The Study

This study assessed the 2D animation competencies and challenges encountered by BTLED-ICT students at the College of Teacher Education, Zamboanga Peninsula Polytechnic State University, focusing only on those who had completed the 2D Animation NC II coursework. The research was delimited to a sample of 79 students from first to fourth year, thereby excluding students from other colleges or programs who may also have relevant animation training and experiences. The findings are further limited by the use of a self-reported survey questionnaire, which may be subject to response bias and may not fully capture the actual depth of students' technical skills. Data collection was conducted exclusively during the second semester of the 2023–2024 academic year, restricting the results to the conditions and resources available at that specific time. Moreover, external factors such as socio-economic disparities, varying access to personal technology, and different learning environments outside the institution were not extensively explored. These limitations suggest that while the study provides valuable insights into the competencies and challenges of BTLED-ICT students, caution should be taken in generalizing the results to other populations or academic contexts.

VI. Recommendations

Based on the findings of this study, it is recommended that the College of Teacher Education at Zamboanga Peninsula Polytechnic State University strengthen the technical training of BTLED-ICT students in 2D animation. While students demonstrated competence in producing key poses and creating digital cut-out animations, additional focus should be placed on improving their skills in traditional animation and exporting animations with higher technical precision. Faculty members may integrate more project-based activities and simulation tasks to provide students with real-world applications of their skills. To further enhance instructional delivery, it is advised that updated modules, tutorials, and software tools be incorporated into classroom practice. Providing access to advanced multimedia resources and learning platforms will also ensure that students can engage in self-directed

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learning and practice animation techniques independently. These improvements will contribute to building stronger competencies aligned with TESDA standards and industry expectations.

In terms of addressing challenges, the university should prioritize upgrading facilities, equipment, and IT infrastructure to better support animation courses. Ensuring reliable access to functional computers, updated software such as Adobe Animate, and stable internet connectivity will help minimize barriers to learning. Additionally, clearer IT policies and more comprehensive training on digital tools should be introduced to empower students with confidence in using available technologies. The institution may also explore financial support programs, such as scholarships or subsidies, to assist students from low socio-economic backgrounds in accessing the required resources. Strengthening partnerships with industry stakeholders could provide opportunities for mentorship, internships, and exposure to professional animation practices. By implementing these recommendations, the institution can foster an enabling learning environment that enhances both the competencies and professional readiness of BTLED-ICT students in 2D animation.

Disclosure on the Use of Generative AI

This article utilized generative AI solely to enhance language clarity and coherence, without altering the original research findings or interpretations.

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