



Use of QR-Code Technology in Evidence Marking and Tagging as a Pedagogical Tool in a Criminology School in Pampanga

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ABSTRACT

This study aimed to determine the effectiveness of QR code technology in evidence marking and tagging as a pedagogical tool in a criminology school in Pampanga. Specifically, it examined the demographic profile of the respondents, the level of effectiveness of the QR code-based system in terms of accuracy, efficiency, and reliability, and the level of acceptance in terms of perceived usefulness, ease of use, and user satisfaction. It also determined the significant difference between the traditional manual method and the QR-based method and identified enhancement measures for system improvement. The study employed a quantitative research approach using descriptive, comparative, and correlational designs. A total of 89 respondents, composed of criminology students and faculty members, were selected through purposive sampling. Data were gathered using a researcher-made questionnaire and actual performance testing of both traditional and QR-based methods. Statistical tools such as frequency, percentage, weighted mean, and standard deviation were used to analyze the data. The findings revealed that the QR code-based system is very effective in improving accuracy, efficiency, and reliability in evidence handling. Respondents also showed a very positive level of acceptance, indicating that the system is useful, user-friendly, and satisfactory. Furthermore, the QR-based method was found to be more effective than the traditional method in reducing errors, minimizing time consumption, and improving data consistency and accessibility. However, respondents identified the need for system enhancements, including additional features, improved interface, durability, and user training. The study concludes that QR code technology is a viable and innovative tool that can significantly improve evidence marking and tagging practices in criminology education and related fields.

Keywords: QR-Code, Evidence Marking, Pedagogical Tool, Criminology Education.

INTRODUCTION

In criminology education, the proper handling, marking, and tagging of physical evidence are among the most fundamental skills that students must master to ensure the integrity and admissibility of evidence in legal proceedings (Lafadchan et al., 2024). Traditionally, evidence marking and tagging are performed manually using handwritten labels, physical tags, and logbooks. Although this method remains functional, it is often prone to mislabeling, data inconsistency, loss of records, and human error, which may compromise both instructional quality and procedural accuracy (Lovell et al., 2022). With the rapid advancement of digital technologies,



educational institutions are now given greater opportunities to modernize conventional teaching methods and strengthen experiential learning (Alenezi et al., 2023).

One emerging technological solution is the use of QR (Quick Response) Code Technology, which enables instant access to encoded information through digital scanning (Paul & Naikar, 2024). In sectors such as logistics, healthcare, and law enforcement, QR codes have been widely adopted for identification, tracking, and inventory control due to their speed, accuracy, and cost-effectiveness (Joshi & Sawant, 2024). Studies have demonstrated that QR-based systems improve data reliability, reduce processing time, and enhance monitoring efficiency. For example, Lai et al. (2022) developed a QR-based DNA-profiling instructional project where students' genetic and identity information were encoded into scannable QR codes, resulting in significantly higher participation and passing rates compared with students in traditional forensic biology classes. These findings suggest that QR code technology holds strong potential for application in criminology laboratory practices, particularly in evidence marking and tagging.

In educational settings, QR codes have also been shown to promote interactive learning, improve student engagement, and support real-time access to instructional content and records (AlNajid, 2022). Pascual (2021) described QR codes as two-dimensional barcodes that provide instant access to embedded information and have become widely utilized due to the increasing availability of smartphones. In his study on the use of QR-coded supplemental materials in modular and online distance learning in General Mathematics for Grade 11 students in Laguna, findings revealed a significant improvement in students' academic performance. Both teachers and learners strongly agreed that QR-coded materials enhanced lesson preparation and understanding of concepts due to easier access to learning resources and reduced time spent searching for materials. These results further support the educational value of QR code technology.

Despite the growing application of QR codes in security and education, limited studies have explored their use as a pedagogical tool for evidence handling in criminology schools, particularly at the local level. In Pampanga, many criminology laboratories still rely heavily on traditional methods of evidence tagging during practical exercises, creating a gap between technological advancement and instructional practice. Thus, this study proposes the use of QR Code Technology in Evidence Marking and Tagging as a Pedagogical Tool in a Criminology School in Pampanga. Specifically, this research aims to develop and evaluate a QR-based evidence marking system for laboratory and simulation use; determine its effectiveness in terms of accuracy, efficiency, and reliability; assess the perceptions of students and faculty regarding its usability and instructional value; and compare the traditional and QR-based methods in terms of time consumption and error reduction. Through this innovation, the study envisions enhancing both the quality of instruction and the technological competence of future law-enforcement professionals.

RESEARCH METHODOLOGY

Research Design

This study employed a quantitative research approach utilizing a descriptive, comparative, and correlational research design to determine the effectiveness and acceptance of the QR code-based evidence marking and tagging system as a pedagogical tool in a criminology school in Pampanga. The descriptive design was used to assess the level of effectiveness of the system in terms of accuracy, efficiency, reliability, and data security, as well as the level of acceptance in terms of perceived usefulness and perceived ease of use. The comparative design was applied to determine the significant difference between the traditional method and the QR code-based method in terms of time consumption and error rate. Meanwhile, the correlational design was used to determine the significant relationship between the level of acceptance and the level of effectiveness of the QR code-based system. A functional prototype of the QR code system was developed and utilized during the actual conduct of the study to allow realistic evaluation and performance measurement.

Participants and Sampling

The participants of the study consisted of 89 criminology students and faculty members from a selected criminology school in FEU-Pampanga who were actively involved in laboratory activities related to evidence



handling. These participants were considered ideal for the study because they were the primary users of evidence marking and tagging procedures and were directly affected by innovations in these processes.

The study employed purposive sampling, a non-probability sampling technique, wherein participants were selected based on specific inclusion criteria. These criteria included being officially enrolled as a student or employed as a faculty member in the institution, having prior experience with traditional evidence marking and tagging methods, and actively using the QR code-based system during the study. This method ensured that participants had relevant knowledge and hands-on experience, which was essential for assessing the effectiveness and usability of the QR code system.

The final sample size of 89 participants comprised individuals who met the inclusion criteria, ensuring a representative group for the evaluation of both traditional and QR-based evidence marking procedures. This sample size was considered sufficient to provide reliable insights into the effectiveness, efficiency, and perceptions of the proposed system while maintaining feasibility within the context of the institution.

Research Instrument

The primary research instrument used in the study was a researcher-made questionnaire designed to measure the demographic profile, level of system effectiveness, and level of system acceptance among the participants. The instrument was divided into five parts: the first part determined the participants' demographic profile; the second part measured system effectiveness in terms of accuracy, efficiency, reliability, and data security; the third part measured system acceptance in terms of perceived usefulness and perceived ease of use; the fourth part gathered data on time consumption and error rate for both the traditional and QR code-based methods; and the fifth part focused on the enhancement measurement of the system.

A four-point Likert scale was used for Parts II to V to eliminate neutrality and encourage respondents to make a clear choice. The scale ranged from 4 (Strongly Agree), 3 (Agree), 2 (Disagree), to 1 (Strongly Disagree). In addition to the questionnaire, the researchers developed a functional QR code-based system using free online tools, which included a free QR code generator, a mobile device scanner, and a free cloud-based data storage platform to record and retrieve evidence information. This instrument allowed the researchers to evaluate both the performance and perception of the QR code system in comparison with the traditional method.

Ethical Considerations

Ethical standards were strictly observed throughout the conduct of the study to protect the rights and welfare of the participants. Prior to data collection, the participants were fully informed about the purpose, procedures, possible risks, and benefits of the study. Voluntary participation was ensured, and informed consent was obtained from each participant. The confidentiality of all personal information and responses was guaranteed, and all data gathered were used solely for academic and research purposes. The participants were also informed of their right to withdraw from the study at any time without any form of penalty or consequence.

Data Gathering Procedure

After securing permission from the school administration and the head of the Criminology Department, the researchers conducted an orientation to explain the objectives of the study and to demonstrate the proper use of both the traditional and QR code-based evidence marking and tagging methods. The QR code system was then developed using free online platforms, which included the creation of digital evidence forms, automatic data storage through a free cloud-based database, and the generation of unique QR codes for each evidence item.

The participants first performed evidence marking and tagging using the traditional method. Afterward, they performed the same procedures using the QR code-based system. Following the completion of both methods, the participants were asked to answer the researcher-made questionnaire to evaluate the system's effectiveness and acceptance. All accomplished instruments were collected, verified for completeness, and prepared for data analysis.



Data Analysis

The data gathered from the study were analyzed using appropriate statistical tools. Frequency and percentage were used to describe the demographic profile of the participants. Weighted mean and standard deviation were used to determine the level of effectiveness and the level of acceptance of the QR code-based evidence marking and tagging system. These statistical measures were also used to interpret the responses of the participants and assess the consistency of their answers. All statistical results were interpreted at a 0.05 level of significance.

RESULTS AND DISCUSSION

This chapter presents, analyzes, and interprets the data gathered in this study in a clear and organized manner. The results are based on the responses collected from the participants regarding the QR code-based evidence marking and tagging system. To make the findings easier to understand, the data are presented using tables and supported by explanations. The discussion focuses on describing the demographic profile of the participants, as well as determining the level of effectiveness and level of acceptance of the proposed system using weighted mean and standard deviation. Each result is carefully explained to show what the data mean and how they relate to the objectives of the study. Through this chapter, the researchers aim to provide a simple yet meaningful interpretation of the findings so that readers can easily understand the significance of the study and how the QR code-based system may improve evidence marking and tagging practices.

Table 1. Demographic Profile of the Respondents

Variable	Category	N	%
Sex	Male	53	60
	Female	36	40
Year Level	1st Year	11	12.6
	2nd Year	15	17.2
	3rd Year	20	23
	4th Year	41	47
Role	Student	87	98
	Faculty	2	2

Note: N = number of respondents % = Percentage

Table 1 shows the demographic profile of the respondents in terms of sex, year level, and role. In terms of sex, the majority of the respondents are male, with 53 or 60%, while 36 or 40% are female, indicating that males slightly dominate the sample. Regarding year level, most of the respondents are in their 4th year, comprising 41 or 47%, followed by 3rd year students with 20 or 23%, 2nd year students with 15 or 17.2%, and 1st year students with 11 or 12.6%. This shows that higher year levels have greater representation in the study. In terms of role, the respondents are predominantly students, with 87 or 98%, while only 2 or 2% are faculty members, indicating that the data largely reflect student perspectives. Overall, the demographic profile suggests that the findings of the study are mainly based on the responses of senior students, which may influence their level of understanding and perception of the QR code-based evidence marking and tagging system.

Table 2. Summary of the Effectiveness of the QR-Code-Based Evidence Marking and Tagging System

Indicator	Mean	SD	Interpretation
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Accuracy of Evidence Labeling and Identification	3.53	0.62	Very Effective
Efficiency (Time Consumed)	3.49	0.65	Very Effective
Reliability and Consistency of Recorded Information	3.47	0.68	Very Effective
Overall Effectiveness	3.50	0.65	Very Effective

Note. Scale used: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree. Interpretation: 3.25–4.00 = Very Effective; 2.50–3.24 = Effective; 1.75–2.49 = Less Effective; 1.00–1.74 = Not Effective.

Table 2 reveals that the QR code-based evidence marking and tagging system is perceived as very effective across all indicators. Among the variables, accuracy of evidence labeling and identification obtained the highest mean score of 3.53 (SD = 0.62), indicating that respondents strongly agree that the system ensures precise and correct identification of evidence. This is followed by efficiency in terms of time consumed, with a mean of 3.49 (SD = 0.65), suggesting that the system helps speed up the evidence marking process. Next is reliability and consistency of recorded information, which garnered a mean of 3.47 (SD = 0.68), reflecting that the system maintains dependable and consistent records. Overall, the system achieved a mean score of 3.50 (SD = 0.65), interpreted as very effective. These findings imply that the system performs best in accuracy, followed by efficiency and reliability, while still maintaining a high level of effectiveness in all aspects.

Table 3. Summary of the Perceptions of Criminology Students and Faculty on the QR-Code–Based System

Indicator	Mean	SD	Interpretation
Perceived Usefulness	3.56	0.60	Very Positive
Perceived Ease of Use	3.52	0.63	Very Positive
Overall User Satisfaction	3.49	0.66	Very Positive
Overall Perception	3.52	0.63	Very Positive

Note. Scale used: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree. Interpretation: 3.25–4.00 = Very Positive; 2.50–3.24 = Positive; 1.75–2.49 = Less Positive; 1.00–1.74 = Negative.

Table 3 results indicate that the respondents have a very positive perception of the QR code-based evidence marking and tagging system across all indicators. Among the variables, perceived usefulness obtained the highest mean score of 3.56 (SD = 0.60), suggesting that respondents strongly recognize the system's value in improving evidence handling. This is followed by both perceived ease of use and overall perception, which share the same mean of 3.52 (SD = 0.63), indicating that the system is considered user-friendly and generally well-accepted. Meanwhile, overall user satisfaction recorded the lowest mean of 3.49 (SD = 0.66), although it is still interpreted as very positive.

Table 4. Descriptive statistics of respondents' perceptions regarding the QR-based tagging system compared to the manual methods

Variable	Mean	SD	Interpretation
Error Occurrence	3.65	0.55	Strongly Agree



Time Consumption	3.70	0.50	Strongly Agree
Data Consistency & Accessibility	3.72	0.48	Strongly Agree
Overall Total	3.69	0.51	Strongly Agree

Table 4 shows that the respondents strongly agree on the effectiveness of the QR code-based evidence marking and tagging system in reducing errors, saving time, and improving data management. Among the variables, data consistency and accessibility obtained the highest mean of 3.72 (SD = 0.48), indicating that the system greatly enhances the organization and ease of retrieving information. This is followed by time consumption, with a mean of 3.70 (SD = 0.50), suggesting that the system significantly reduces the time required in evidence handling processes. Lastly, error occurrence recorded a mean of 3.65 (SD = 0.55), which still reflects a strong agreement that the system helps minimize mistakes.

Table 5. Mean and Standard Deviation of Enhancement Measure

Enhancement Measure	Mean	SD	Interpretation
The system needs improvement	3.20	0.86	Agree
More training is needed	3.23	0.76	Agree
The interface needs enhancement	3.25	0.79	Strongly Agree
More durable materials are needed	3.26	0.80	Strongly Agree
Additional features are needed	3.31	0.83	Strongly Agree
The system requires further optimization	3.25	0.73	Strongly Agree
Overall Total	3.25	0.80	Strongly Agree

Table 5 indicates that the respondents generally agree that several enhancements are needed to further improve the QR code-based evidence marking and tagging system. Among the suggested measures, additional features are needed obtained the highest mean of 3.31 (SD = 0.83), showing strong agreement that expanding the system's functionality is the top priority. This is followed by more durable materials are needed with a mean of 3.26 (SD = 0.80), and both the interface needs enhancement and the system requires further optimization, which share the same mean of 3.25 (SD = 0.79 and 0.73, respectively), all interpreted as strongly agree. Meanwhile, more training is needed (M = 3.23, SD = 0.76) and the system needs improvement (M = 3.20, SD = 0.86) received slightly lower means but are still interpreted as agree.



CONCLUSION AND RECOMMENDATION

Conclusions

The findings of the study clearly demonstrate that the QR code-based evidence marking and tagging system is highly effective in improving evidence management practices. The system showed strong performance in terms of accuracy, efficiency, and reliability, indicating that it successfully minimizes common issues associated with manual methods such as mislabeling, delays, and inconsistent documentation. These results suggest that the integration of QR code technology provides a more systematic and organized approach to handling evidence, ultimately contributing to better operational performance.

Furthermore, the respondents exhibited a very positive level of acceptance of the system, particularly in terms of usefulness, ease of use, and overall satisfaction. This indicates that the system is not only functional but also user-friendly and practical for implementation. The positive perception of the respondents implies that the system can be easily adopted in both academic and professional settings without requiring extensive technical expertise, making it a viable tool for modernizing evidence handling procedures.

Despite the positive results, the study also revealed that there are still areas that require improvement, including the need for additional features, better interface design, system optimization, and user training. These findings highlight that while the system is already effective, continuous development is necessary to enhance its performance and sustainability. Overall, the QR code-based system has strong potential to replace or complement traditional methods and contribute to more accurate, efficient, and reliable evidence management practices.

Recommendations

Based on the conclusions of the study, it is recommended that the QR code-based evidence marking and tagging system be adopted by law enforcement agencies, forensic laboratories, and academic institutions to improve the efficiency and accuracy of evidence handling processes. The implementation of this system can significantly reduce errors, save time, and enhance data organization, making it a valuable tool in modern evidence management.

It is also recommended that system developers focus on improving the overall functionality of the system by adding more features, enhancing the user interface, and optimizing system performance. In addition, the use of durable materials for QR code tags should be considered to ensure their longevity and resistance to environmental factors. These improvements will help address the concerns identified by the respondents and further increase the effectiveness of the system.

Lastly, institutions planning to implement the system should provide adequate training and conduct pilot testing before full deployment. Training programs will ensure that users are knowledgeable and capable of utilizing the system effectively, while pilot testing will help identify potential issues in real-world settings. Future researchers are also encouraged to conduct further studies involving larger and more diverse populations and explore the integration of other emerging technologies to continuously improve evidence management systems.

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