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Identifying Physics Measuring Instruments with Google Lens: A Descriptive Classroom Study

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ABSTRACT

Limited access to laboratory measuring instruments can constrain students' opportunities to recognize measurement devices and connect them with physical quantities and units. This study describes the classroom use of Google Lens as a visual-search aid for identifying physics measuring instruments. Participants were 60 Grade X students from classes X-1 and X-2 at SMA Negeri 1 Panarukan. Students used Google Lens to examine 12 images of measuring instruments and completed worksheets requiring five elements for each image: instrument name, measured quantity, type of quantity, unit shown on the instrument, and SI unit. A descriptive trial-and-error procedure was used, and responses were scored from 0 to 5 for each image. The original classroom data show that 39 students obtained scores of 81–100 and 13 obtained scores of 61–80; consequently, 65% were categorized as very good and 22% as good, giving a combined 87% in the good or very-good categories. Google Lens identified some instruments directly, while other images required additional searching, discussion, and reasoning because recognition was affected by image source, camera focus, and lighting. These findings indicate that visual search can provide a practical supplementary resource for introducing measuring instruments when physical laboratory equipment is limited. Because the study used descriptive classroom data without a comparison group or pretest–posttest inferential analysis, the results should not be interpreted as a causal estimate of learning effectiveness.

Keywords: Google Lens; physics measurement; visual search; smartphone learning; laboratory resources

INTRODUCTION

Measurement is foundational to school physics because students must connect observable phenomena with quantities, units, instruments, and evidence. In the original classroom context, an initial formative assessment indicated that only about 5% of the participating students were familiar with physics measuring instruments, while 90% reported that they had rarely used science measuring devices during junior secondary school. The school laboratory also had limited equipment, although approximately 95% of students had Android smartphones. These conditions motivated the use of a smartphone-based visual-search tool as a supplementary learning resource rather than as a replacement for hands-on laboratory work.

Digital technologies can broaden access to representations, explanations, and inquiry resources when their use is aligned with a clear learning task. Reviews of technology-enhanced learning emphasize that

learning gains depend on instructional design, guidance, cognitive load, and the quality of learner activity rather than on the device alone (Darling-Hammond et al., 2020; Hillmayr et al., 2020; Mayer et al., 2020; Noetel et al., 2021; Skulmowski, 2024). In science education specifically, smartphones have been used as sensors, data-collection tools, visualization devices, and gateways to external information (Liu et al., 2021; Ubben et al., 2023). These affordances are particularly relevant where conventional laboratory resources are incomplete.

Google Lens combines camera-based image recognition with visual search. Previous educational applications have included object identification and STEM-related activities, including plant identification and biology learning (Nuraini et al., 2022; Shapovalov et al., 2018; Shapovalov et al., 2019). More broadly, augmented and camera-mediated learning can support visualization and inquiry, but recognition errors, hardware constraints, and extraneous information can also interfere with learning (Irwanto et al., 2022; Vidak et al., 2024). Therefore, students should evaluate search outputs rather than accept them uncritically.

This study addresses a practical question: how well can students use Google Lens to identify physics measuring instruments and associated physical quantities from images in a resource-constrained school setting? The study describes the identification process, the difficulty patterns encountered across instruments, and the distribution of student scores. The contribution is deliberately bounded: it documents a classroom implementation and its descriptive outcomes, while avoiding causal claims that would require a stronger experimental design.

LITERATURE REVIEW

Measurement Literacy and Physics Learning

Understanding measurement requires more than naming an instrument. Students need to identify the quantity being measured, distinguish base and derived quantities, select appropriate units, read scales, and interpret uncertainty. These practices are part of scientific reasoning and should be connected to explanation and evidence rather than memorized as isolated facts. Active and generative learning research indicates that retrieval, explanation, comparison, and feedback can strengthen durable learning when tasks direct attention to relevant relationships (Agarwal et al., 2021; Brod, 2021; Carpenter et al., 2022; Fiorella, 2023; McDermott, 2021; Wisniewski et al., 2020).

Digital representations can supplement physical apparatus when access is limited, but they do not reproduce all features of authentic measurement. Meta-analytic and review evidence suggests that digital tools can support mathematics and science learning, especially when they provide task-relevant representations and are integrated with teacher guidance (Hillmayr et al., 2020; Castro-Alonso et al., 2021; Noetel et al., 2022; Sundararajan & Adesope, 2020). Accordingly, image-based identification is best treated as preparation for, or reinforcement of, hands-on measurement rather than a substitute for instrument manipulation.

Smartphones, Visual Search, and Augmented Learning

Smartphones are increasingly used in science education because they combine cameras, sensors, connectivity, and computation in a familiar device. A systematic review by Ubben et al. (2023) found diverse uses of smartphones across science education, while Liu et al. (2021) showed that mobile technologies can support inquiry processes in secondary science when activities are appropriately scaffolded. Technology acceptance and teacher competence also influence whether such tools are used productively (Antonietti et al., 2022; Falloon, 2020; Lucas et al., 2021; Seufert et al., 2021).

Visual-search and augmented-reality approaches can overlay or retrieve information about objects observed through a camera. Systematic reviews report potential benefits for visualization, engagement, and collaborative inquiry in science and physics, but they also identify recognition errors, device limitations, and cognitive-load risks (Irwanto et al., 2022; Vidak et al., 2024; Sebastian & Kuswanto, 2024). In Google Lens activities, the pedagogically important step is therefore not merely obtaining a search result but checking whether the result corresponds to the target object and to the physics concept being studied.

Instructional Design, Critical Evaluation, and Digital Competence

Technology-rich activities are most effective when students are asked to generate explanations, compare alternatives, and receive feedback. Multimedia-learning research warns that visually rich environments may add irrelevant details unless information is coherent and signaling directs attention to the learning goal (Alpizar et al., 2020; Castro-Alonso et al., 2021; Mayer et al., 2020; Wong & Adesope, 2021). In the present activity, incorrect or ambiguous Lens results can become prompts for critical evaluation rather than simply being treated as failures.

Teachers also require digital competence to select tools, anticipate constraints, and connect technology to curriculum objectives. Research on teacher digital competence and technology integration highlights the roles of professional knowledge, readiness, contextual support, and purposeful instructional planning (Backfisch et al., 2020; Fernández-Batanero et al., 2022; Howard et al., 2021; König et al., 2020; Tondeur et al., 2021; Wohlfart & Wagner, 2023). This perspective supports a cautious use of Google Lens: the application is a means for inquiry and information access, while conceptual validation remains part of teacher-guided physics learning.

METHODS

Research Design, Setting, and Participants

The study used a descriptive classroom experiment with a trial-and-error procedure. It was conducted with 60 Grade X students from classes X-1 and X-2 at SMA Negeri 1 Panarukan. The instructional objects were 12 images of physics measuring instruments. The available source manuscript does not report random

assignment, a control group, inferential hypothesis testing, instrument reliability, or individual-level raw data; therefore, the analysis is presented descriptively (Loeb et al., 2017; Brown et al., 2018).

Learning Task and Scoring

Students used Google Lens to inspect images of a balance, roll meter, stopwatch, thermometer, multimeter, lux meter, vernier caliper, speedometer, sphygmomanometer, measuring cylinder, an additional caliper image, and a pressure gauge. For each image, students recorded five elements: (1) instrument name, (2) measured quantity, (3) type of physical quantity, (4) unit displayed on the instrument, and (5) corresponding SI unit. Each image was scored from 0 to 5 according to the number of correct elements.

Table 1. Scoring guide for physical-quantity identification in each image

Score	Description
0	All five elements incorrect
1	One element correct
2	Two elements correct
3	Three elements correct
4	Four elements correct
5	All five elements correct

Total performance was converted to a percentage and interpreted using the categories retained from the source manuscript: 81–100 = very good, 61–80 = good, 41–60 = fair, 21–40 = poor, and 0–20 = very poor. Because the source reports only aggregate category results, no confidence intervals, paired tests, or standardized effect sizes were calculated.

Table 2. Performance categories used in the source study

Score range	Category
81–100	Very good
61–80	Good
41–60	Fair
21–40	Poor
0–20	Very poor

RESULTS AND DISCUSSION

Google Lens Identification Process

Students first directed the Google Lens camera toward the set of measuring-instrument images and then focused on individual instruments. The source report indicates that Lens did not always return the intended instrument or the required physical quantities directly. Students therefore had to inspect search results, crop or refocus images, discuss alternatives, and determine the appropriate quantity and unit. This

distinction is important: the classroom task combined automated visual search with human verification and physics reasoning.

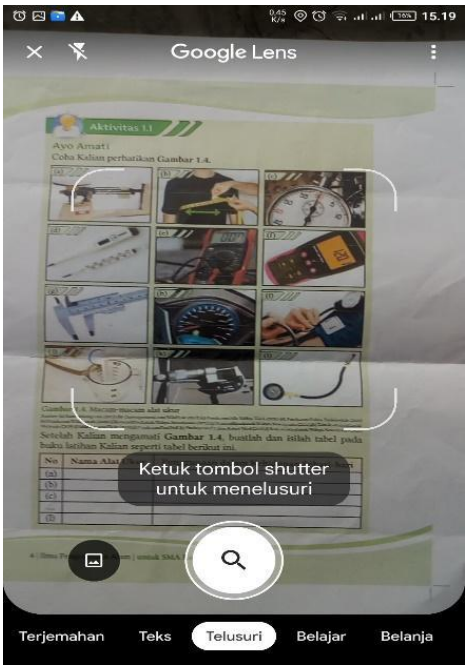


Figure 1. Google Lens interface used to inspect images of physics measuring instruments
Note. Image retained from the source manuscript for documentary continuity.

The source manuscript grouped the visual-search experience into three practical difficulty levels. Instruments such as the balance, stopwatch, multimeter, vernier caliper, speedometer, and measuring cylinder were described as relatively easy because Lens commonly returned the intended object. The roll meter and sphygmomanometer were categorized as moderate because search results could be visually similar but semantically incorrect. The lux meter and tire-pressure gauge were among the difficult cases; Lens sometimes returned unrelated objects. These errors are consistent with a broader limitation of camera-mediated recognition: output depends on visual features, framing, image quality, and the information available to the recognition system. Reviews of AR and smartphone-supported science learning likewise emphasize that technical affordances must be accompanied by instructional guidance and critical checking (Ubben et al., 2023; Vidak et al., 2024).

Student Reasoning and Worksheet Activity

After identification, students discussed the physical quantities associated with each instrument. The source narrative reports that they considered why Lens results differed from the target image and identified image source, camera focus, and lighting as relevant factors. This phase potentially shifts the activity from passive searching toward evidence evaluation: students must decide whether a retrieved label is plausible,

connect it with prior knowledge, and justify the relevant quantity and SI unit. Such generative activity is more consistent with effective technology-supported learning than simply displaying information (Fiorella, 2023; Skulmowski, 2024).



Figure 2. Example of the student worksheet used for instrument and quantity identification
Note. Student worksheet image retained from the source manuscript.

Distribution of Student Scores

The aggregate results show that 39 students obtained scores in the 81–100 range and 13 students obtained scores in the 61–80 range. Based on the reported percentages, 65% of students were classified as very good and 22% as good. The combined proportion in these two categories was therefore 87%. The remaining students were distributed across fair (5%), poor (5%), and very poor (3%) categories.

Table 3. Student performance categories reported in the source study (N = 60)

Category	Percentage (%)
Very poor	3
Poor	5
Fair	5
Good	22
Very good	65

The 87% figure should be interpreted as the proportion of students whose worksheet scores fell in the good or very-good categories under the study's scoring rubric. It does not by itself establish that Google Lens caused an improvement in learning, because no comparison group or validated pretest–posttest analysis was reported. A stronger design would compare Lens-supported instruction with another condition, document baseline equivalence, report instrument quality, and retain individual-level scores. This cautious interpretation is consistent with contemporary guidance that educational technology should be evaluated through both learning design and evidence quality (Darling-Hammond et al., 2020; Tondeur et al., 2021; Skulmowski, 2024).

Implications for Resource-Constrained Physics Laboratories

For schools with limited measuring instruments, visual search can help students become familiar with the appearance, names, quantities, and units associated with equipment before direct laboratory work. Smartphone access can also make such preparation scalable. However, the activity should include explicit verification prompts, trusted reference materials, and opportunities to handle real instruments whenever possible. Google Lens should therefore be positioned as a supplementary identification and inquiry tool, not as evidence that virtual recognition can replace authentic measurement practice.

Limitations

The study involved 60 students from two classes in one school and relied on aggregate descriptive results. The source manuscript does not provide a control group, validated achievement instrument, reliability coefficients, individual scores, duration of exposure, or delayed follow-up. The list of 12 images also appears to contain a duplicated caliper entry, which should be checked against the original instructional materials. In addition, Google Lens output can change over time as the service and search index evolve. These limitations restrict generalization and causal interpretation.

CONCLUSION AND RECOMMENDATIONS

Google Lens was used as a visual-search aid to identify 12 images of physics measuring instruments and to support students in determining instrument names, measured quantities, quantity types, displayed units, and SI units. In the reported classroom data, 65% of students were categorized as very good and 22% as good, yielding a combined 87% in the two highest categories. The activity also revealed that image source, camera focus, and lighting can influence recognition and that some instruments require substantial human verification. The results support the practical feasibility of Google Lens as a supplementary resource in a school with limited laboratory equipment, but they do not demonstrate a causal learning effect. Future research should use a comparison group or a well-documented pretest–posttest design, validated measures,

individual-level analysis, and explicit reporting of implementation fidelity and ethical procedures. Classroom use should combine visual search with teacher guidance, critical evaluation of search results, and subsequent hands-on measurement whenever equipment is available.

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