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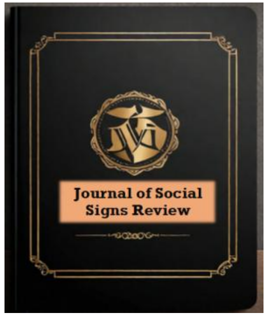

Augmented Reality (AR) for Hands-On Skill Development: Case Study of Vocational/Technical Departments

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Abstract

The use of Augmented Reality (AR) in vocational and technical education has provided new opportunities related to the development of skills based on immersion and practice particularly in settings associated with resource restrictions. The objective of current research is to examine the way AR-based tools can affect the performance in hands-on learning and student involvement in vocational training. The case study methodology was used in three technical institutions which provide courses in automotive repair, electrical work, and CNC machining. The study employed a mixed-methods research design, involving pre- and post-training performance evaluation, student questionnaires and interviews with instructors. These AR tools were mobile 3D simulations, wearable headsets (such as Microsoft HoloLens), and interactive workbench overlays. The research has assumed that AR will offer the contextual, real-time feedback, which would enhance the procedural memory and save reliance on the physical resources. Findings indicated considerable differences in capacity to learn skills and procedural accuracy and motivation of the students where AR-trained students performed higher average in practice assessments by 18 compared to control conditions. AR tools were more consistent, repeatable, and in control of the learner than conventional demonstration-based techniques. There were shortcomings however, cost, fatigue of the device and in some cases tracking errors were reported. The inference of the studies supports the claim that AR is a very effective tool in practical skill development in a workplace and suggests the use of scalable hybrid deployment paradigms as well as teacher education to implement it long-term.

1. Introduction

Even when the technical education arena is changing at an alarming pace, practical skill development has been one of the key pillars in vocational training programs. The old techniques like physical simulations, instructor-led demonstrations are resource-intensive, time-bound, and may be hard to scale. Educational institutions, in their turn, are resorting to immersive technologies, such as Augmented Reality (AR) to boost experiential learning. AR is used to overlay digital content on the physical world, offering the students an opportunity to learn hands on with real world tasks and may provide visual, auditory, or haptic feedback (Akcayir and Akcayir, 2017). The ability of AR to recreate real-world processes without the danger or possible cost of physical breakdowns renders it especially useful in occupational fields like automotive repair, welding, electrical installation, and CNC machining.

Even though AR-based learning is becoming more popular, based on the extent of existing research, the majority of it deals with general education or STEM settings, and there is insufficient research that is based on vocational training settings. In addition, although AR has been reported to enhance cognitive performance and engagement, limited literature has discussed the potential of AR in the acquisition of procedural and psychomotor skills that are needed in technical areas. One of the assumptions that prevailed is immersive technologies will automatically improve the skills transfer, but this was not practically proven in diverse technical areas. Also, the context-specific evidence is absent in developing or under-resource educational environments where AR could be viewed as a very important instrument to add to the poor infrastructure.

The research question that will be discussed in the study is whether AR-based tools have an effect on the practical skills learning in vocational departments and what is the case study approach in three institutions. The purpose of it is to evaluate the effect of AR on the learning outcomes, student motivation, and instruction practices in areas where procedural accuracy is needed. The integrated performance data, student evidence, and instructor pours over the study, presenting a comprehensive idea of the effectiveness and dilemma of AR in technical educational institutions. The results can further advance the recent research body on the area of immersive learning as they provide context-specific with practical implications on the pedagogical benefits and scalability of AR in vocational environments. The article will continue with literature review of related literature and then the methodology, findings and implementation suggestions given on the practice in the resource limited settings.

2. Literature Review

The application of augmented reality (AR) in the educational setting has received a significant amount of attention since it can help eliminate the divide between theory and practice. AR can be used as a revolutionary technology in the vocational and technical education where practical skills are widely required. The review examines the existing studies within four themes, which are interconnected and interrelated, these four include the role of AR in experiential learning, of AR in the development of psychomotor skills, student engagement and motivation, and challenges in implementing AR within vocational education.

Theme 1: AR in Experiential and Situated Learning

Augmented Reality (AR) has become a potent medium of providing experience-based and situational learning, which are two approaches used in vocational learning. Both of these pedagogies are based on experiential learning theory developed by Kolb and structured learning as developed by Lave and Wenger, the focus of these pedagogies is learning by doing and situating the learning. AR enhances the gap between theory and practice; digital content is superimposed on the physical space of the learner to enable students to deal with the real objects and environments and be guided with the help of digital information (Ibanez and Delgado-Kloos, 2018).

This mixed interface will enable the learners to undergo a task based learning activity and get one step-by step instructions right within their line of view. An example of this is that AR applications can be used to overlay wiring diagrams onto electrical panels, or make the internal workings of an engine appear to move as a student performs actions on the physical parts. Context aware systems enable real time cognitive scaffolding, enabling learners to imagine processes not being seen and eliminate instructor dependency during the early practice (Bacca et al., 2014). Most studies indicate that students that utilize AR in work-related situations demonstrate better procedural knowledge, better spatial knowledge and better memory retrieval because the immersive nature helps them encode complicated operational actions. As compared to the conventional lecture or textbook-based teaching, AR enables learners to touch, feel, and see cause-and-effect relationships as well as provide instant feedback in a virtual but real world (Wojciechowski and Cellary, 2013). Such benefits are especially relevant in technical areas where small mistakes can have an expensive or risky effect.

In addition, AR facilitates drilling practice without the need of resources, which is quite useful in institutions where resources would be limited. It allows students to have repetitions of tasks without consuming real parts and thus the learner has control over how he/she works and eliminates performance anxiety. The autonomy combined with guidance assist in strengthening the confidence and competence, which is crucial in preparing vocational learners to the real job. It should be mentioned, though, that even though AR does increase the level of immersion, the effectiveness thereof relies on the instructional design and the contextual alignment. AR tools that have been poorly integrated in the sense of being too complex or not addressing the goals of the tasks may result in cognitive overload or frustration. Thus, the implementation process needs an analytical combination of the curriculum with the input of the instructors collaborative design so that the digital overlay enhances the practical learning and does not distract it.

Overall, the existing literature intends to back the statement that AR, designed and delivered in an efficient way, can be seen as a pedagogical bridge between theoretical knowledge and practical action. It improves experiential learning through the visualisation of invisible concepts, situated cognition and permitting a situationally safe practice of complex technical skills.

Theme 2: Learning Psychomotor Skills and Mastery of Procedures

Psychomotor skills which entail co-ordination of physical movements and manual dexterity are vital in vocational and technical studies, in training careers like welding, electrical and CNC machining, and vehicle repairs. Conventional forms of training are based on demonstration by an instructor, physical repetitions as well as availability of special equipment. Even though this is effective, the methods are resource-consuming, time-consuming, and can at times be risky to beginners of an institution. AR is an interesting substitute involving learners to train on procedural tasks in low-risk and guided conditions, and use motor processes vital to mastery of skills.

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There exists a number of empirical studies that reinforce the potential of AR in the creation of an artistic precision in procedure. As an example, a medical training study demonstrated that AR-surgical simulations have the potential to become much more effective in hand-eye skills, task accuracy, and retention of procedural steps than text-based or video-mediated control groups (Barsom et al., 2016). The simulated AR findings are also mirrored in technical learning, with simulations of AR showing success in previously unpractical tasks such as wire-stripping, torque application and component assembly with quantifiable effectiveness (Tang et al., 2019). The immediate feedback of AR like haptic, audible and visual acknowledgment assists individuals in correcting mistakes in an activity they are engaged in and also strengthens correct methods since it reinforces them instantly.

The other benefit is the capacity of AR to divide complicated processes into small manageable steps. This scaffolding comes in handy especially during the initial stages of instruction when beginners can be confused by multi-staged activities. The AR system enables the procedural continuity by superimposing sequential instructions in the physical workspace of the learner, thereby lessening the need to memorize and the need to be consistently monitored by the teacher. To take an illustration, a student who is being trained on how to wire a circuit can go through holographic instructions that are embedded where each connection is shown in context which enriches understanding and memory.

Notably, AR facilitates repetitive, self-paced practice which is one of the pillars of psychomotor learning. AR modules can also be refurbished and used over and over again unlike consumable physical resources, where learners have to repeat the same task, resulting in wasted materials and damage to the equipment. This enhances not just fluency of skills but also confidence in the learners especially in institutions where practice is curtailed due to limitations of the budget of time.

Nevertheless, there are several restrictions as well as observed in the literature. The psychomotor development capability of AR is dependent on the fidelity of the simulation i.e. the similarity of the AR event to the actual task, in time, movement and haptics feedback. A low-end AR system might not provide accurate motion tracking or tactile feedback in certain instances, and this can make fine motor the development difficult. Furthermore, the use of AR headsets or screens can result in mental exhaustion or physical discomfort, which can be used as a limit to the duration of the session. Nevertheless, overall, the literature agrees that when properly constructed and combined with the practical work, AR has the potential to significantly improve the progress in terms of the procedural and motor skills. It is not a substitute to physical training, but rather a magnifier providing organized, repetitive and feedback rich conditions to speed up the learning process and enhance long term retention.

Theme 3: Motivation and Learner Engagement

Promotion of learner engagement and motivation in educational institutions especially in professional and technical training is one of the most popular advantages of Augmented Reality (AR) which has been reported to date. The vocational learners, who tend to appreciate the applied, hands-on learning process, rather than the abstract theory, are particularly sensitive to those tools that facilitate the process of developing the active, immersive and task-relevant kinds of learning. AR can meet this need by turning monotonous tasks into more dynamic ones and enables instant feedback and turns dull lessons into interactive engagements (Akcayir and Akcayir, 2017).

Research evidence is in favor of AR, indicating that AR elevates the interest of students by helping them experience the presence and realism, thus boosting attentiveness and the level of emotional engagement in the learning process (Bacca et al., 2014). For instance, the learners who learnt by simulating a complex repair or installation using AR claim that they feel more in control and more eager to investigate challenging processes on their own. This is in line with self-determination theory, which argues that self-determination deals with autonomy, competence, and associated relation as the determinants of intrinsic motivation. AR supports all of them in that it allows self-paced learning, offers real-time cues to enhance competence, and in many cases, features collaborative capabilities which allow interaction with peers.

Furthermore, AR has the capacity of minimizing the boredom and cognitive exhaustion caused by repetitive training exercises via the incorporation of gamified content in the form of visual stimuli, achievement badges, or live progress indicators. These elements do not only improve motivation but also give psychological rewards to strengthen the accomplishment of a task. AR (or a place where physical practice becomes costly or unsafe) can offer information of frequent and low-stakes interactions, enabling students to experiment without experiencing failure or damaging the material (Ibanez and Delgado-Kloos, 2018).

Nevertheless, scientists warn that first time exposure to AR can be extremely exciting but there is a possibility of novitivity effect temporary surge in motivation that decays with time as the students get familiarized with the technology (Dunleavy & Dede, 2014). AR can easily end up being a flashy addition to learning unless they are integrated thoughtfully as instructional tools. The engagement can also decrease in case of interface that is too complex, it is technically unreliable, or so not well suited to the learning objectives. This accentuates the significance of convenient design and powerful facilitation by teachers in order to make sure that the interest comes not just to the first stage of curiosity but to the further continual interaction.

Interestingly, other researchers have discovered that AR is especially useful to students who are of lower academic confidence since they could be intimidated by the usual lecture format or find it hard to digest the voluminous text material. To these learners, the visual and tactile affordances of AR give them an alternative route to comprehend thus increasing motivation in vocational classes as well as equity.

In summary, the literature helps to confirm that AR has a significant positive effect in the area of engagement and motivation among the learners, especially when the tools are highly designed, pedagogically based, and instructor scaffolded. AR will enhance active exploration over passive viewing because it will help make vocational and technical education more engaged and more persevering in skills acquisition, which are vital results of earlier learning.

Theme 4: Obstacles in AR Implementation in Vocational Education

Although there is a promising pedagogical potential of the extensive adoption of Augmented Reality (AR) in vocational education, integrating it into educational practice encounters numerous systemic, technical, and pedagogical challenges. These issues are especially strong in the situations when there are limited resources because technical infrastructure, teacher training, and alignment to the curricula are usually low. The knowledge of these barriers is the key to the effective implementation and maintenance of AR in practical learning settings.

Infrastructure and Cost Prohibition

One of the most mentioned obstacles of AR adoption has been high implementation costs. High-end AR systems like the head-mounted displays (i.e. Microsoft HoloLens), industrial spec tablets as well as real time rendering programs need a serious investment in terms of cost that most vocational centers are not able to afford (Lee, 2012). Where cheaper mobile AR applications are implemented even, the schools should provide access to matching devices, dependable internet, and adequate bandwidth. These facilities demand a significant challenge to the public vocational institutions, particularly in developing areas.

Professional Development and Teacher Preparation

Another significant obstacle is the absence of familiarity of the instructors with AR tools. Most vocational teachers have strong technical skills in their profession yet they are unfamiliar with the developing digital technology. The studies indicate a lack of professional growth opportunities because most teachers may not properly integrate AR into the lesson plans because of the perceived complexity and irrelevance, or avoid adopting AR altogether (Akcayir and Akcayir, 2017). This is given further by the unfriendly nature of interfaces and other simple instructional design that builds the necessity of co-designed training models that attend to the real-life requirements of the teachers.

Training: Technical Limitations and Usability Issues

The technical issue can include bad calibration, motion-tracking error, lag, hardware tiredness, etc., which might be detrimental to learning. As an illustration, pauses during the rendering process or crashing of the system during a drill process may disrupt the flow of the task, causing frustration to a learner. Extensive wearing of the AR headsets is also associated with physical discomfort such as dizziness and eye strain especially among the older learners or those learners with sensitivities to their senses. All these problems of usability should point at the relevance of the ergonomic design and reliability, particularly in the training setting where accuracy and comfort should be prioritized (Tang et al., 2019).

Misalignment between Curricular and Assessment

The other shortcoming is the inability to match AR contents with current policies, standards and certification requirements. A significant number of available AR off-the-shelf solutions are created without consideration of vocational educators and may not conclude the procedure steps, safety standards, or tool usage requirements required in technical professions. Also, in the conventional evaluation methods, there is often a focus on written tests or face-to-face performance that does not necessarily project the skills developed in the environment of AR-based practice. Such a mismatch can decrease institutional development of AR adoption unless clear connections to learning outcomes and accreditation standards are provided.

Scalability and Maintenance Problems

The implementation of AR at scale is associated with new challenges, including the necessity to regularly update the software and localize the content, maintain the devices. The institutions need to put in long time support structures such as technical personnel, IT infrastructure and budgeting of replacement/ upgrades. The absence of such a vision may result in the premature burnout of early AR interest as an initiative that may appear like a good idea is left by the wayside because of the lack of resources or funding (Dede and Dunleavy, 2014).

In Summation, although AR presents a revolutionary potential of vocational skill development, its use would be limited by a coincidence of technical, human and institutional obstacles. The literature recommends that to eliminate these obstacles AR solutions should be scalable, low-cost; teachers should be massively trained; support should be through a robust system; and development should be carried out in collaboration with specific educational goals to facilitate the alignment of AR tools.

3. Methodology

Methodological Approach

This study was meant to examine the effects of augmented reality (AR) applications on the growth of practical skills in vocational education. The research utilized a mixed-method and case study design that enabled the researcher to conduct both quantitative and qualitative analysis of student performance and investigate the experience of learners and instructors respectively. The scope was on primary information gathered in three vocational schools that provide technical training in automotive repairs, electrical installation and machining atoms (CNC). The research was mainly descriptive and exploratory and that was meant to help capture the results as well as the contextual variables that influence the integration of AR.

Data Collection Methods

There were quantitative and qualitative methods of data collection to capture a full picture of the learning impact.

Performance Assessments

The students were split into two groups an experimental one in which they used AR tools in the process of having practical training, and a control one where they received the instructions through traditional means. The measurement of the skills in terms of accuracy, speed and completion of the procedure of real-world activities was conducted at pre- and post-training levels.

Surveys

To obtain the results regarding the impressions of engagement, motivation, confidence, and usability of AR, standardized Likert-scale surveys were provided to 60 students in the three institutions.

Instructor Interviews

Semi-structured interviews were used with 9 instructors who participate in using AR. Perceived benefits, challenges and integration strategy interviews. The interviews were recorded, transcribed, and anonymized in each case and took around 45-60 minutes.

Observational Field Notes

To document the pattern of classroom interactions, troubleshooting requirements, and modification of instructions, classroom observations were done during AR-based lessons.
This was facilitated by purposive selection to sample participants who were active in AR-based instructional workshops. All participants were given informed consent.

Data Analysis Methods

Quantitative Data

Paired t-tests were used to analyze the pre and post-test scores to identify statistically significant performance improvements in both AR and control groups. Mean engagement ratings and SDs by the institutions were determined as a value of survey responses calculated as descriptive statistics.

Qualitative Data

They were thematically coded using NVivo interview transcripts and observation notes. Axial coding was used and preceded by an open coding process used to detect patterns through the three sites. Such themes as perceived effectiveness, implementation difficulties, and instructional alignment were involved.

Data sources student performance, survey response and interview with instructors were triangulated to maintain data validity and reliability of results.

Evaluation and Justification

The case study design involving mixed methods has been adopted due to the need to respond to the what and how of the role of AR in vocational training. Quantitative tests have registered quantifiable improvement in learning whereas the qualitative information has shed light on the experience of the learners and teachers. This two-fold method promoted both the richness and generativeness of the results in a variety of technical fields. The study did not lack limitations though. The sample was also not very large hence restricting the generalization of statistical findings. The difference in AR tools and practices in institutions that created contextual differences became hard to manage. These were ameliorated using elaborate case site documentation and cross-site investigation. The novelty effect of AR was also noted in the study and it could cause additional inflating motivation score in the short run; new studies were advised to be conducted to test its effects in the long term.

4. Results

The results are divided according to the type of data and correlated to the research goals of the study: to determine the effect of AR in practical influence on skills and motivating learning and teaching.

Results of the Performance Assessment

Comparison between pre-test and post-test results showed significant positive changes in the performance of hands-on skills in students receiving training by using AR tools in comparison to their performance with the same training practice that involves the use of traditional training methods.

- In the AR (n = 30) group, an average improvement of 18.3% in accuracy of jobs conducted between a pre-test and a post-test was observed.
- The control group (n = 30) had displayed a 9.2% improvement over the same period.
- The difference on the gains between the two groups was statistically significant as indicated by a paired-sample t-test ($t(29) = 3.87$, $p < 0.01$).

Students who had undergone AR training took shorter periods of time to complete procedures (e.g. engine disassembly, wiring setups, CNC code entry) and with fewer critical failures especially in those processes that needed step-by-step accuracy.

Student Survey Findings

Responses of the surveys (n = 60) were helpful to gain an understanding of the attitudes of learners and their engagement level.

Survey Metric	Mean (AR Group)	Mean (Control Group)
Perceived Engagement (1–5 scale)	4.6	3.2
Confidence in Task Execution	4.4	3.5
Ease of Understanding Instructions	4.3	3.3
Motivation to Practice Independently	4.5	3.1

Students of the AR group explained it as more emotional, more interactive, and easier to follow than lectures and a few of them reported a decrease in anxiety when using a complicated procedure.

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Introduction Instructor Interview Themes

The evaluation of the 9 interview with instructors indicated that there were three recurring themes:

Better Procedural Transparency

Teachers noted that AR could be used to make students have a closer visualization of the internal systems (e.g. circuits, engines) and reduced the number of basic errors.

Need for Scaffolding

As stated by teachers, although AR made learners more independent, most of them needed preliminary support to figure out how to use the tools.

Implementation Challenges

A number of the instructors mentioned that there were technical difficulties like delayed calibration, reliance on Wi-Fi, and lack of sufficient training time as obstacles to easier assimilation.

It was quickly picked up by students, but we were early on troubled by troubleshooting. However, it was an impressive sight when it was running, and they followed subsequent to it so well. Instructor 4

Observational Field Notes

Observation on the field revealed that interaction with AR tools was high among the students. Students who participated in an AR-enabled session made less clarification requests during practice activities, were more guided by visuals generated by the system and it took more time to do repetition by self-pacing. Nevertheless, in some instances, there were bottlenecks as two or more students had to use the same AR device or a lag in systems.

Known Limitations

- The inconsistency in the host of ARTs performance influenced uniformity on the user experience.
- The number of weeks of a study may not indicate retention and transfer of skills longer-term.

The surveys were based on self-reported engagement, and this could be subject to the novelty bias.

5. Discussion

This research has shown that augmented reality (AR) can be highly effective in the process of learning skills, teaching students, and improving the efficiency of instruction in the vocational setting. Students that had been trained with AR performed better in procedural accuracy and confidence in the task whereas teachers provided evidence of better student knowledge and more independent student learning behaviour.

The overall performance enhancement of the AR group is in favor of suggesting that context rich real-time feedback enhances the procedural memory and error correction. These findings support the assumption that AR tools facilitate psychomotor learning by decomposing cognitive load and provide an opportunity to rehearse without any restrictions on the material. The positive survey rates of engagement and confidence also point to the fact that AR can be used to support motivational and affective aspects of the vocational training. The feedback by instructors also mentions that although AR makes students more independent, early instructional scaffolding and the stable infrastructure are needed in order to use AR successfully.

The results are consistent with the past research, which highlights the ability of AR to provide immersion and situational learning, as well as enhance the acquisition of technical skills (Bacca et al., 2014); (Ibanez & Delgado-Kloos, 2018). The presented increase in the confidence and the engagement of learners resembles the studies of Akcayir and Akcayir (2017), who discovered that AR technologies enhanced student motivation by supporting the interactivity and visual reinforcement. Reported barriers to implementation issues associated with the instructor (in the form of device fatigue and usability issues) mirror the cautions of Dunleavy and Dede (2014) on technical and pedagogical incompatibilities when using AR at its initial adoption stage. Moreover, the identified necessity of the curriculum alignment is related to Lee (2012), who also stated that it is important to combine AR and formal skills criteria in technical education.

It was found that there were a number of limitations. To begin with, the sample size together with the time constrained the possibility to determine long-term retention or skills creation acquired during AR conditioned in the industry. Second, technical differences between institutions (such as the presence of devices, the speed of internet access, etc.) could be a factor that affected the experiences of students unequally. Third, self-report surveys present the risk of novelty bias in which student interest in new technologies can cause engagement scores to swell. The results indicate that AR is a potentially transformational factor of vocational education when applied in a strategically organized manner. It offers a more scalable, repeatable and cost effective form of practical instruction that is resource intensive. Nonetheless, the institutions should have an investment in the training of teachers, alignment of curriculum, and sustained technical support to make sure it is sustainable. As an educator, AR is a new lens of instructional facilitation, with the role of educator implementing a change in position, which is the learning coach. To policymakers, the findings indicate an investment in hybrid models of AR simulation and traditional workshops that can obtain maximum learning with minimum overspending on finances.

Although the effect of AR use on performance was positive, there is a possibility that high performance was due to the novelty effect or attention of the instructor on AR sessions. In the same manner, students grouped together as AR might have been more motivated under the perception of benefit. Though these factors were adjusted but random assignment and prolonged schedules are needed in any future study to eliminate motivational biases. This paper answered its key question of interest as how AR influences the contribution to hands-on skill development during vocational training and revealed that AR can significantly contribute to procedural learning and engagement in learning as long as some structural requirements are fulfilled. It substantiates that an AR can be a form of motivation tool, as well as the pedagogically successful technology when properly implemented in technical school settings.

This paper aimed to examine the following question: How does augmented reality (AR) affect the practical development of skills and engagement of the learner in vocational and technical training? In the study, the authors examined the performance of the participants in three vocational trainings, the instructor feedback, and student perceptions to determine the effectiveness of AR-based instructional tools. The results obtained support the main hypothesis: AR is a more effective tool in learning procedural skills, motivates students, and allows studying material more independently, accessing learning through the prism of immersion, interactions, and guided practice in the real-time

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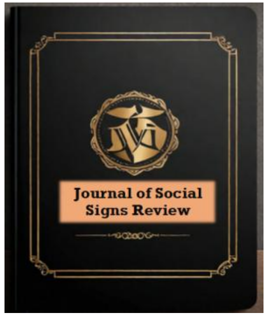

environment. Students with AR tools were more accurate in complex technical tasks and had high confidence in completing the tasks, and instructors found that students have better understanding and flow of activities. These results affirm the argument that AR does not just act as a visual aid, but is a pedagogically disruptive means of experiential learning in technical disciplines.

In addition to the immediate benefits that this research will offer in effects on performance, it is one of the several areas of research that contribute to the larger discourse on the subject of digital innovation in vocational education, where the practical training suffers due to the issue of insufficient resources. The research demonstrates that AR can complement a small physical infrastructure, minimize the amount of waste, and engage learners in a deeper way especially in low equipments and professor time environments. Returning to the topics proposed in the literature, the research supports the relevance of context-sensitive, skill-suited, and instructor-regulated AR combination. It also reveals the main issues, like the issue of device tiredness, technical stability, and necessity of a continuous professional development process to help teachers in implement the tools in a more successful way.

So what? These results are important since they suggest that AR has the ability to fill historic divides in vocational education between theory and practice, equity and access, motivation and mastery. In the case of educators, the question and answer are obvious: technical education can be improved and extended to a greater number of people through the opportunities of low-barrier AR and strong training and infrastructure. To conclude, future studies must explore the retention after a long period of time, skills that can be transfigured to other industries and the cost-benefit of AR in career practices. As the market of skilled trades grows stronger all over the world, so should our interest toward creative, efficient, and inclusive fading and AR is one of the major stakeholders of this future.

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