TJ -0.015 Tc 0.072 Tw 19.867 0 Td [(I)-15.3 (t)-17 (wa)-11.1 (s)-12.6 ( )]
opportunities.

Keywords: augmented reality, learning, industrial sector

How to assemble an

1 Motivation

Research concerning the use of Augmented Reality (AR) has been strongly focused on technical dimensions in the past and has only started to thoroughly explore AR use in different application scenarios around 2016 [1]. Especially in the context of use in the industrial sector, a literature review identified "assembly", "maintenance", "product design" and "training/learning" as topics that were investigated more in detail [2]. The paper however also criticizes that many studies never implemented AR in a real context, thereby leading to a lack of real case implementations.

In October 2021, we conducted a literature analysis of 54 scientific papers regarding Learning and AR following the concept matrix approach of [3] (see section 3). Our results indicate that latest scientific work put an emphasis on school and higher education environments, confirming the findings of [2]. Furthermore, the most often represented aim was to increase student's "motivation to learn" or "improve learning performance". In contrast, learning scenarios in an industrial operations context were hardly considered. Only 8 papers concerned learning performance improvement in this area.

case, water from the jar is directly transferred into the glass below. An ultrasonic distance measurement

Five high-level concepts could finally be identified in current research on AR for learning: (1) “Acceptance of AR in learning”, (2) “Increase motivation to learn”, (3) “New way to display information to learners”, (4) “Improve learning performance”, and (5) “Different use cases for learning with AR”. For each concept, the papers were labeled according to their target environments: schools, higher education, apprenticeships, and operating business. Given the detailed outcome, we found that research in the area of AR and learning is mostly concerned with teaching in schools and higher education. On the other hand, there seemed to be a gap in studying AR-supported learning for professional training and in enterprise environments. The little number of sources found in this direction were almost exclusively linked to the concept “improve learning performance” and barely touched other concepts. We thus derive the following research question (RQ) grounded on the before analyzed knowledge base:

RQ: “How can learning in industrial operations be supported and improved by means of Augmented Reality?”

This RQ manifests the significance of our artifact design to the research community. By our design approach, the RQ shall be examined against the backdrop of the five identified concepts in literature through a qualitative evaluation of the artifact. Thereby this prototype paper contributes to the scientific knowledge base by presenting new insights on potential usage value of AR in industrial operations contexts and extends the yet under-researched area of applied AR-supported learning in environments other than schools and universities.

4 Significance to practice

A core activity of our institutions is to cooperate closely with small and medium-sized companies (SMEs) in digital transformation projects, many of which are in industries such as manufacturin1.6 (e)1 Tw 3.34

5 Evaluation of the learning station

Currently, 14 tests were performed with 7 users using the paper-based instructions and 7 using the AR solution. The tests were embedded in a qualitative assessment of the designed LS. Comparison studies between a conventional version and AR use were found to be common in existing literature evaluating A