Position Paper

**XR qualification lags behind its needs**

Stuttgart/Fellbach, May 2nd, 2022 – The Virtual Dimension Center (VDC) identified XR qualification needs and compared them with today’s offers. Numerous deficits are visible.

**Background**

In recent years many companies dealt with future workplace concepts. In this context, the most interesting and promising technologies include virtual reality (VR) and augmented reality (AR). The question is not whether these will find their way into the world of work, but rather how strong the changes will be. A variety of companies, e.g. in the automotive industry, are already using different forms of virtual reality. With the change at the workplace site, the job profile also changes. It is therefore already necessary to teach certain basic knowledge of the new technologies during the course of study or professional education in order to respond to this change in job profiles.

VR and AR are cross-sectional technologies / methods that can encompass a huge number of knowledge domains. These include perception / cognitive psychology, ergonomics, computer graphics, acoustics, haptics, user interface design, hardware development, software development, etc. In addition, practical use requires concentrated knowledge from the industry verticals and from application domain (e.g. design, maintenance, ergonomics, industrial engineering, marketing communication, etc.).

**Study design: method to assess qualification needs**

A group of experts [3] moderated by the VDC developed six XR job profiles: 1. software developer / app, 2. visualization expert / IT specialist, 3. 3D real-time artist / 3D artist, 4. designer, R&D engineer, 5. process manager / process advisor / process engineer and 6. CDO/CDEO chief digital officer. A total of forty possible XR qualification modules were also identified.

The industry’s XR qualification demands were determined via a company survey across all six XR job descriptions and across all forty XR qualification modules [5]. For this purpose, interviews were conducted with sixteen long-standing XR experts from the economy (from the IT, vehicle construction, mechanical engineering, consulting sectors), who also played a role in the hiring process of new employees.
Due to the heterogeneity of the companies using XR, a representative survey was neither effective nor feasible. The long-standing experts were advised to only provide answers for those XR job descriptions that also occur in their respective company.

Furthermore, eighteen university teachers were asked about their assessment of the required XR know-how - specifically for each XR job description [3]. Assuming that the university teachers meet this perceived need, this assessment was interpreted as a course offer. The XR qualification offer of the universities was thus known.

A number of XR education textbooks [3] were also considered. They were examined to determine which of the identified forty XR qualification modules they contain. By this we knew the XR qualification offer of the XR textbooks.

The status quo

Of course, universities today offer a wide range of XR courses [1,2]. There is also a whole series of excellent XR textbooks [3].

Fundamental changes in our working environment do not leave the relationship to education / training untouched. In order to successfully and sustainably implement XR in companies, the development of technological and organizational skills is required. The XR technology application is increasingly moving from specialists from external technology service providers to business users.

Several studies made it clear that today's XR qualification offerings do not exactly match the needs of business and research. Furthermore, the XR qualification does not reach all relevant target groups. Neither all the necessary qualifications, nor all the sectors that need to be addressed, nor all the phases of professional life that need to be addressed are adequately taken into account. As a result, the actual use of XR falls significantly short of its potential, with all the consequences, such as untapped potential benefits, lagging behind in the digital transformation, lower competitiveness, higher process costs, longer response times, etc. The following section names the most important fields of action.
New requirements for XR qualification

1. Teaching requires the means to keep pace with technology

The current education system is reaching its limits. It has no chance of keeping up with very fast-moving technology trends, since there is a lack of equipment and time resources to constantly familiarize yourself with new things: for institutes and further education facilities, too, the ongoing qualification of their own is not a business model, but simply an expense that has to be financed. XR as an interaction technique is an experience that can only be understood by experiencing it. XR practical experience is therefore absolutely essential, both in terms of experiencing XR and in terms of operation, setup and programming of current technology. Top technology issues cannot be dealt with outdated equipment.

2. We need "Third Places of Learning"

It is an exception that a company hires XR specialists fresh from university and they then work and develop in the field of XR for years. Even if the schools / universities here bring well-qualified people onto the labor market, their knowledge is outdated after a few years. More often, users with strong industry and application knowledge find themselves in the situation that XR becomes one of their new work tools. The same applies to the decision-makers in the company for such a scenario. So, what is urgently needed are extra-occupational XR qualification offers. These offers are also relevant for companies that want to add XR solutions and XR services to their product portfolio. In general, in the XR context, extra-occupational training and further education is in great demand.

More agile concepts are therefore required in XR qualification. In addition to universities and companies, we need "third places of learning", since even the German model of dual studies / dual training cannot impart the latest, fast-moving cutting-edge technologies quickly enough. These third places of learning could be technology centers, research institutions; Metaverses should be discussed as platforms. At these third places of learning people are needed who constantly monitor certain cutting-edge technologies and pass this information on to companies and universities.

3. Educational certificates / degrees between university and product training

The processing of 3D data into content usable by XR devices is making progress towards automation, also with the help of increasing standardization and AI approaches. However, it is foreseeable that there will still be a lot of manual preparation work, since it is also about developing story boards (e.g. in XR-based training) or interpreting data (e.g. assignment of functions of 3D-scanned components). People still have to make this effort, but not all activities in the field of 3D content development require a university degree. The professions of 3D real-time artist and sometimes also software developer require qualification levels that are located between university studies and product training, for example at vocational training level.
4. Let’s get XR into the educational pathways of later adopters

For the XR job profiles of visualization experts, R&D engineers and process managers in the role of users and operators of the XR platforms, there must be more offers for "XR as a work tool". These future users must acquire XR-relevant knowledge of their industry vertical and their respective XR application domain. This knowledge includes typical workflows, work processes, roles, methods, IT tools used and (3D) data. What is important in all of this is, that the future users and operators do not see XR as an IT issue, but rather as a process issue: the main obstacles to successful XR use lie in the work process, not in the technology (you always get technology done with more or less efforts). The knowledge addressed here is to be imparted in the courses of study of relevant industries and fields of application, i. e. mechanical engineering, architecture, construction, chemical engineering, medicine, vehicle engineering, electrical engineering, textiles, design, marketing communication, business administration, etc.

The use of XR should not be limited to applications that require academic training. There are already successful XR applications in crafts, trade and retail today. Here, too, XR training offers must be made, either as part of initial vocational training or as part of further life-long learning.

5. XR qualification needs new contents

In an area that is developing as dynamically as XR, it is always necessary to check for new qualification requirements. A problem here is the long duration (e. g. 3 years) associated with the change in the study examination regulations. Here, too, more agile concepts are required, such as flexibly formulated modules (degree) or learning fields (vocational training).

Furthermore, the obstacles of XR diffusion into practical use must be taken into account much more when it comes to defining XR teaching content.

- provide a holistic understanding of XR

   The XR scene moves a lot, not only technologically, but also on the market side, e. g., in terms of the formation of technological ecosystems and platforms. Initiatives like Metaverse, which are endowed with gigantic budgets, will have large economic impacts that need to be assessed. At the same time, they raise new questions in the context of data and copyright protection, in data security. Today, these issues are not adequately addressed in education.

- IoT: width and depth

   Students shall be enabled to explore the XR area extensively at universities. Only by doing this, they can make the right XR-related decisions later in their professional life. Depending on the focus of their education profile, specialized courses should be used to convey more technical depth.
- Develop of XR management skills

In the vast majority of XR lectures at German colleges and universities, XR is treated as an IT topic, very strongly influenced by hardware topics, which reflect human perception as input / output technology, complemented by areas of perception psychology and XR software. However, this content is of little help in making decisions in favor or against using XR. This aforementioned knowledge is therefore hardly relevant for the decision-making level (i.e. XR job profile process manager, CDO, CDEO). So, what we actually need is XR-relevant decision-making authority for later or already active managers. Let us think about bringing knowledge of XR cost-benefit analysis, XR law, leadership (and employee involvement) and XR project management into the curriculae of engineering, law, business informatics, industrial engineering or business administration.

- UX and standardization in XR system development

The XR technology knowledge formulated in XR textbooks is a comprehensive and certainly a very good starting point for the qualification of XR software developers. However, some aspects may still receive too little attention at the moment. While clear interaction standards have emerged in the area of desktop computer systems and for touch-controlled devices (smartphones, tablet PCs), this is the case for XR only to a very limited extent. Just a few paradigms such as teleportation in HMD-based VR seem to gain ground. Since the usability barrier can still be found among the VR diffusion barriers, it would be good to transport more knowledge about usability, user experience (UX) and XR standards - here especially interaction standards. In addition to UX and standardization, a third point is relevant for the job profile of XR software developers: XR never was and is not an isolated topic, but a cross-sectional technology that has to be integrated very strongly in everyday professional life: XR must process 3D data from other domains and take on disciplines; the use of XR must lead to real decisions and substantial support services. A useful development of XR applications is therefore only feasible in close coordination with future users and customers. This understanding is essential.
Summary

Today there are a variety of XR educational offerings - conventional and digital - and excellent textbooks with a comprehensive overview of various XR topics. The educational offerings consist mainly of university lectures and product training. At the same time, it is obvious that there are still significant obstacles to the diffusion of XR methods into commercial enterprises. These obstacles (e.g. cost hurdles) are only partially resolved, but unfortunately most aspects are permanent. The job descriptions of those who deal with XR are very divergent. This inevitably means that many differently adapted XR educational offers should be made. XR as a cross-sectional technology must be very closely interlinked with application knowledge, industry knowledge, other domains and disciplines. Lifelong learning is widely promoted today, but there are hardly any XR training opportunities for working people.

References


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