EDUCATING ENTREPRENEURIAL ENGINEERS - TO BE CONTEXT-AWARE OR GENERIC?

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ABSTRACT

Entrepreneurship education (EE) is high on the agenda of governments and universities globally. With the new forms of entrepreneurship, there has been a surge of specific training programs and materials, e.g. ones dedicated to social entrepreneurship as well as for science & technology-based entrepreneurship.

Parallel to this division of EE into subsegments, tools and methods such as the Business Model Canvas (BMC), Lean Start-Up and Customer Development methods, or Disciplined Entrepreneurship by MIT have spread to be used by EE practitioners globally.

With the increasing globalization, virtualization, and mobility of learners, EE courses have learners differing in 1) their cultural context that reflects in their values and beliefs, 2) their educational and professional background, and 3) in the area - market and industry - where they aim to start their business. E.g., the process of entrepreneurship is likely to differ in dynamics when going into medical technology vs. mobile gaming, yet some aspects may be mutual to both businesses.

Thus, EE education is facing a dilemma: How unified and non-context specific should the approach of the educator be to deliver EE in scale and keep the EE program manageable vs. how much to focus on the individuals or teams and their specific context.

The paper draws its conclusions based on the quantitative survey done among 60 entrepreneurship educators globally in February-March 2022. The global respondent pool consisted of educators diverse in the context they come from, institutions and faculties they work at, and the type of entrepreneurs they have trained. The data analysis is based on descriptive statistics based on the assessments done by the respondents on 4- or 5-step Likert scales on perceived current EE practices and the perceived importance of different factors in successfully context-aware EE. The core taxonomy used to elaborate on context is the PESTEL-analysis of the environment, consisting of Political, Economical, Social, Technological, Ecological and Legal factors.

The results indicate that the economical-technological consideration is weighted in today’s EE generally speaking, whereas the truly context-aware EE would balance that leaning to economical and technological matters with more factors, especially the one of social context. Another takeaway to participants is a set of proposed EE designs that deal with the contradicting forces.
1 INTRODUCTION

1.1 The meaning(s) of context

Context is a construct both wide and widely used in research and development across disciplines. In business and industrial research, context can mean a specific set of environmental variables in which an organization operates (external context) but also the characteristics or a category of the organization under study (internal context). In addition, contexts can be studied either as the possession of specific characteristics of an individual or of a community. Individuals are likely to interpret their surroundings differently because of their differing habits, routines, and intelligence. Parallel to that individual interpretation, however, we identify ourselves not only as individuals but as parts of social systems we link to [1]. In practice, since these two scopes are inbuilt and interdependent. What we perceive as our context (our habits, experiences, values, etc.) has been and continuously is affected by other individuals and institutions around us – the schools we go to, courses we take as well as companies and markets we operate in. Institutions such as Higher Education Institutions (HEIs) engaged in business, engineering, and entrepreneurship education act as a context relevant for this study. Likewise, industries and companies offer specific contexts to which individuals and entrepreneurial teams adapt.

Since engineering is fundamentally built on science-backed findings in natural sciences, technology-related views and skills have the potential to be less context-dependent than more culturally bounded functions in business activity, such as HRM or marketing. In other words, “technology travels well”. In the same vein, it can be argued that in technology-based entrepreneurship the market opportunity and competition are global, whereas in cultural and service-based industries the scope is more likely to be local or regional. Despite a potential lowering of contextual boundaries, the context has still been claimed in research to play an important role in issues such as innovation, inter-organizational learning, and entrepreneurial actions.

For the scope of this study, we synthesize the prior research on context stating that 1) context is both situational as well as a prevailing condition that in its part explains, directs, and delimits action, 2) context is both an individual as a social/institutional construct, and 3) context is present – consciously or subconsciously – in multiple areas of entrepreneurship and engineering (education) research and practice.

1.2 Context and context-awareness as factors affecting educational practice

Following the ideas of the previous section, understanding the concept of context is a solid starting point for analysis of how context(s) affect education. Adaptive
context-aware learning environments (ACALEs) are expected to detect learners’
context and adapt learning contents to match the context identified to make
education more relevant to learners [2]. Context-aware systems understand the
situational needs and offer at the right time the relevant information.
Learning context consists not only of individual learners with differing contexts but
also of the social fabric they jointly create and to which also the educators pertain.
The concept of learning spaces consisting of physical, social, cognitive, and virtual
environments captures in a wider meaning the context for education.
Also, the context that an educator brings into a learning space moderates the
learning process. Some studies like conclude that the “teacher effect” outweighs the
effect of the methods used in learning efficiency and student achievement [3]. It has
become imperative that educators in the modern world with characterized by
increased mobility of people, immigration, refugee crisis, etc. acquire competencies
in the diversity of contexts present. Does this apply also to subsegments of
education in engineering and education – and their combination?

1.3 Context and context-awareness in entrepreneurship

A big part of the entrepreneurship education within HEIs’ entrepreneurial courses
and incubation/acceleration programs focuses on students in business and science
/technology majors. Companies born in these environments are so-called born
globals. These companies conduct international business at or near the founding of
the firm. Events in recent decades – primarily globalization and the emergence of
key technologies – have facilitated the rise of born globals.
As a result of the opportunities and role models offered by successful young but
global entrepreneurs, EE has embraced methodologies suited to the goals of growth
and internationalization. Methods such as Customer Development, Lean Start-up,
Business Model Canvas, Design Thinking, and MIT’s Disciplined Entrepreneurship
have spread to entrepreneurial programs across continents, universities, and
faculties. This trend depicts EE as a rather context-independent phenomenon.
However, entrepreneurship as an activity has been described as a context-laden and
context-bounded phenomenon worth studying with the context in focus [4]. There are
studies on the impact of regional, technological and institutional context on EE. This
paper adds to the body of knowledge on context-aware entrepreneurship education,
with a focus on the technology element of context.

2 METHODOLOGY

The research method of this paper is a quantitative one based on a survey directed
to scholars who had published within the last 4 years in the regional and local
conferences on entrepreneurship education (EE) and/or were known by the
researcher team to act as entrepreneurship educators. Some of the respondents had
written their studies based on EE within Schools of Engineering, but the
organizational background of respondents or research focus outside the “entrepreneurship education” definition was not a selection criterion. The survey link was sent to some 250 respondents, in addition to which the receivers were requested to spread the link to their EE network. The assumption on the response rate is some 20%. Data were collected in February-March of 2022, as a cross-sectional explorative study aimed at identifying the interesting areas for further studies with larger data sets and a qualitative approach focusing on the root causes for the findings reported in this paper. Demographically the respondent pool was heterogeneous, 43.3% of the respondents were females and ages were distributed to 5%/20-30 years, 21.7%/31-40 years, 40%/41-50 years, 20% /51-60 years/ and 13.3%/over 60 years). Present educational contexts were: in North America 20%, Mid- and South America 1.7%, Europe 60%, Africa 1.7%, and Oceania16.7%, thus Mid- South America and Africa are underrepresented. On average respondents had acted 12 years as an entrepreneurship educator. The learning spaces of respondents were described by 28.3% as monocultural, 46.7% as somewhat multicultural, 7% as quite multicultural, and by3% as very multicultural. Due to a relatively small dataset gathered at the time of writing this paper, the results are presented with descriptive statistics, further papers are targeted to contain more data and analyses on statistical significance.

3 RESULTS

3.1 On current practices of context-aware entrepreneurship education

First, the respondents’ views of the general context-awareness practiced in entrepreneurship education were screened, after which it could be mirrored in the respondents’ self-perceived view on their context-awareness in EE.

<table>
<thead>
<tr>
<th></th>
<th>Is very rarely context-aware</th>
<th>Is sometimes context-aware</th>
<th>Is often context-aware</th>
<th>Is very often context-aware</th>
<th>Is always context-aware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneurship education…</td>
<td>6,8%</td>
<td>37,3%</td>
<td>30,5%</td>
<td>20,3%</td>
<td>5,1%</td>
</tr>
</tbody>
</table>

Table 1. Q: “How well do you perceive contextual issues are taken into account in Entrepreneur education generally speaking?”

<table>
<thead>
<tr>
<th></th>
<th>I am not context-aware</th>
<th>I am sometimes context-aware</th>
<th>I am often context-aware</th>
<th>I am always context-aware</th>
</tr>
</thead>
<tbody>
<tr>
<td>In my Entrepreneurship education…</td>
<td>1,8%</td>
<td>17,5%</td>
<td>71,9%</td>
<td>8,8%</td>
</tr>
</tbody>
</table>

Table 2. Q: “How would you describe your context-awareness in Entrepreneurship Education?”

As a comparison of Tables 1 and 2, it can be stated that the study attracted EE practitioners with higher context-awareness than their average EE peers. This may
lead to overinterpretation of findings, but also the findings may act as a model for more context-aware (if that is needed, see section 3.2.) EE of the future.

3.2 Is context in entrepreneurship education technology-sensitive?

A common way to describe a context/operational environment made of elements is the PESTEL-analysis, made of political, economic, social, technological, ecological, and legal factors. Our findings (Tables 3-5) propose that a) different PESTEL areas of context enjoy varying perceived importance in successful EE, b) the current practices highlight the importance of context as a technical-economic system, and c) the context-aware teachers (our sample) perceive themselves to be context-aware in a more balanced way across PESTEL-factors, but still d) they put even more weight into economic-technological context than they perceive to be common in EE.

<table>
<thead>
<tr>
<th></th>
<th>Very unimportant</th>
<th>Quite unimportant</th>
<th>Not important nor unimportant</th>
<th>Quite Important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political context</td>
<td>5.2%</td>
<td>12.1%</td>
<td>17.2%</td>
<td>39.8%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Economical context</td>
<td>1.7%</td>
<td>1.7%</td>
<td>3.5%</td>
<td>31.1%</td>
<td>62.1%</td>
</tr>
<tr>
<td>Sociological context</td>
<td>3.4%</td>
<td>1.7%</td>
<td>8.6%</td>
<td>46.6%</td>
<td>39.7%</td>
</tr>
<tr>
<td>Technological context</td>
<td>1.7%</td>
<td>1.8%</td>
<td>8.8%</td>
<td>33.3%</td>
<td>54.4%</td>
</tr>
<tr>
<td>Environmental/ecological context</td>
<td>3.4%</td>
<td>5.2%</td>
<td>19%</td>
<td>25.9%</td>
<td>46.5%</td>
</tr>
<tr>
<td>Legal context</td>
<td>1.7%</td>
<td>5.2%</td>
<td>13.8%</td>
<td>44.8%</td>
<td>34.5%</td>
</tr>
</tbody>
</table>

Table 3. Q: “How would you rate the importance of contextual issues for a successful entrepreneurship education?”

<table>
<thead>
<tr>
<th></th>
<th>Never taken into account</th>
<th>Sometimes taken into account</th>
<th>Often taken into account</th>
<th>Always taken into account</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political context</td>
<td>10.1%</td>
<td>42.4%</td>
<td>39%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Economical context</td>
<td>0%</td>
<td>17%</td>
<td>52.5%</td>
<td>30.5%</td>
</tr>
<tr>
<td>Sociological context</td>
<td>1.7%</td>
<td>37.3%</td>
<td>55.9%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Technological context</td>
<td>0%</td>
<td>23.7%</td>
<td>42.4%</td>
<td>33.9%</td>
</tr>
<tr>
<td>Environmental/ecological context</td>
<td>1.7%</td>
<td>42.4%</td>
<td>44.1%</td>
<td>11.8%</td>
</tr>
<tr>
<td>Legal context</td>
<td>5.3%</td>
<td>38.6%</td>
<td>45.6%</td>
<td>10.5%</td>
</tr>
</tbody>
</table>

Table 4. Q: “Which contextual elements do you perceive are taken into account in Entrepreneurship education generally speaking?”

<table>
<thead>
<tr>
<th></th>
<th>Never taken into account</th>
<th>Sometimes taken into account</th>
<th>Often taken into account</th>
<th>Always taken into account</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political context</td>
<td>10.2%</td>
<td>35.6%</td>
<td>37.3%</td>
<td>16.9%</td>
</tr>
<tr>
<td>Economical context</td>
<td>0%</td>
<td>6.8%</td>
<td>45.8%</td>
<td>47.4%</td>
</tr>
<tr>
<td>Sociological context</td>
<td>1.7%</td>
<td>18.6%</td>
<td>47.5%</td>
<td>32.2%</td>
</tr>
<tr>
<td>Technological context</td>
<td>1.7%</td>
<td>19.9%</td>
<td>36.2%</td>
<td>43.1%</td>
</tr>
<tr>
<td>Environmental/ecological context</td>
<td>6.8%</td>
<td>22%</td>
<td>45.8%</td>
<td>25.4%</td>
</tr>
<tr>
<td>Legal context</td>
<td>5.1%</td>
<td>35.6%</td>
<td>28.8%</td>
<td>30.5%</td>
</tr>
</tbody>
</table>
One interesting finding is the weak focus on legal matters as compared to technological/economical factors. If the legislation was able to reflect the prevailing trends in business and technology, the legal considerations would match in importance a) technology areas such as artificial intelligence, cybersecurity, and robotics would follow, and b) business trends and models such as marketing automation, platform businesses, etc. As this is not the case in our data, we conclude that the technological/economical context keeps developing and changing at a higher clock speed than other areas of PESTEL affecting EE.

4 SUMMARY AND ACKNOWLEDGMENTS

We conclude our findings by stating that context still matters, despite the “global village” of mixing cultures and the fast-spreading of novel technologies across the world. The technological context still is a powerful contextual moderator. We suggest the research community pay attention to technological context and adapt the prevalent models to the degrees of technology sophisticatedness and intensity.

We aim at adding with our future work to add to the knowledge pool on the subject through qualitative research. We also encourage research on the technological context and studying that phenomenon via the constituents that make it: What are the differentiators between different technological contexts relevant to be taken into account in engineering-based entrepreneurship: Infrastructure, skill levels, availability of technology suppliers, technology levels of potential customers?

Due to the limited size of the sample, the generalizability of the results is limited, especially in African and Mid-/South-American contexts. Despite that shortcoming, our aim at exploratory research that would help to understand the phenomenon under study better and indicate areas for further study was reached.

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REFERENCES

