CHALLENGING BIAS IN BIG DATA USER FOR AI AND MACHINE LEARNING

WP2 Competency Matrices for the "Algorithmic Bias" Experts external Peer Review (Short Report)

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1. Introduction: the Charlie project

1.1. The Charlie project: overview

CHARLIE is an ERASMUS+ KA2 project with an implementation period of 30 months, between 30/12/2022 - 29/06/2025. The project is being conducted by a consortium of SIX (6) partners from five (5) European countries: Spain, Portugal, Romania, Finland and Denmark.

Artificial Intelligence (AI) is in our everyday life. From the algorithm that recognizes our face when we are walking down the street feeding police biometric security services to the algorithm that chooses the advertising we will see in our social media, AI is everywhere. But although Machine Learning (ML) and AI are mathematics they are not always right and this happens because the data that is processed to come to any conclusion can be, and often is, biased. Social sciences have been studying Human Bias for many years. It arises from the implicit association that reflects bias we are not conscious of and that can result in multiple negative outcomes. AI and ML are not designed to make ethical decisions, which are not an algorithm for ethics. It will always make predictions based on how the world works today, therefore contributing to fostering the bias and discriminatory practices that are systemically rooted in our societies today. With the widespread use of AI and ML technologies, often owned by big tech companies with the only objective of making profits, there is an urgent need to bring a human-centered approach to tech and use it to solve social problems instead of contributing to them. In its Communication of 25/04/18 and 7/12/18, the EC set out its vision for artificial intelligence, which supports "ethical, secure and cutting-edge AI made in Europe"? AI systems need to be human-centric, resting on a commitment to their use in the service of humanity and the common good, with the goal of improving human welfare and freedom. While offering great opportunities, AI systems also give rise to certain risks that must be handled appropriately and proportionately. We now have an important window of opportunity to shape their development.

CHARLIE intends to ensure that we can trust the sociotechnical environments in which they are embedded. We also want producers of AI systems to get a competitive advantage by embedding Trustworthy AI in their products and services. This entails seeking to maximise the benefits of AI systems while at the same time preventing and minimising their risks. Higher Education (HE), Adult Education (AE) and Youth require new and innovative curricula that can meet this skills gap and that can equip learners with the knowledge and skills to contribute to a more ethical approach to tech development. The need to make tech education more human is aligned with the Digital Education Action Plan that includes specific actions to address the ethical implications and challenges of using AI and data in education and training.

1.2. Project objectives

CHARLIE aims at challenging the bias in big data used for AI and machine learning by bringing a greater level of awareness regarding the negative impacts of the lack of a critical and ethical approach to techEd. CHARLIE main objectives are to:

1. Increase the capacity of HE institutions to provide its students online learning opportunities that meet society needs but also are tailored to students learning needs;

2. Increase Tech students' social and ethical competencies, allowing them to engage positively, critically and ethically with AI/ML technology;

3. Equip teachers/professors with digital and engaging approaches to effective teaching the topic (especially in online teaching);

4. Create synergies between HE organizations and AE and Youth at regional level in the field of AI ethics education;

5. Potentiate the transferability of academia courses on AI biases to AE and VET;

6. Raise awareness about the topic at society level

1.3. Expected overall results of the Charlie project per WP

1- Competency Matrices for the "Algorithmic Bias" course (EQF6), the "Ethical AI microcredential" (EQF4) and the Serious Game (EQF2) (WP2)

2- "Algorithmic Bias" course (HE) - bLearning approach: a) synchronous sessions (preferably face-to-face), b) eLearning asynchronous sessions for theoretical component, complemented with a digital serious game as formative assessment and online summative assessment, delivered as .scorm ready to be upload in any LMS for students enrolled in Big Data, AI, machine learning, deep learning related courses. (WP3)

3- "Algorithmic Bias toolkit for synchronous sessions" - for Teachers/Professors/Lecturers implementing the synchronous sessions (face-to-face or online) that complement the eLearning asynchronous sessions. (WP3)

4- A guideline for boosting the capacity of university administrators/management of Education and Training departments in charge of digital education provision to foster digital education delivery on Algorithmic Bias. (WP3)

5- Webinars to foster peer-learning and discuss the role of HE institutions in techEd, to foster interdisciplinary of social sciences in tech education and to discuss approaches for interoperability with Youth and AE. (WP3)

6- Self-paced "Ethical AI" microcredential (EQF4) for Adult learners to be taken online and asynchronous. (WP4)

7- Digital Serious game (EQF2) for Youth 12-18 years (mainly disadvantaged/young women) to foster gender representation in STEM from a young age. (WP4)

8- Toolkit to support Adults and Youth in upskilling into Ethical AI. (WP4)

9- Policy recommendation for recognition of the microcrential for adult learners in accessing HE courses in technological fields. (WP4)

1.4. Charlie Target Groups

The CHARLIE project main target-groups are:

- HE institutions that provide Big Data, AI, machine learning, deep learning related learning opportunities/courses and its respective administrators/management of Education and Training departments

- HE Students enrolled in Big Data, AI, machine learning, deep learning related courses

- HE Teachers/Professors/Lecturers from either social sciences and techEd

- AE organisations and their staff

- Adults of all ages and socio-economic backgrounds, aiming to progress towards higher qualification levels relevant for the labour market and for active participation in society.

- Youth organisations and their staff

-Youth (12 to 18 years old) - especially young women and youth from social disadvantaged contexts (facing barriers linked to education system; cultural differences; social barriers; economic barriers; barriers linked to discrimination; and geographical barriers)

1.5. WP2 Objectives

Competency Matrices for the "Algorithmic Bias"' WP specific objectives are:

- to set a common understanding about the purpose and learning goals of a learning pathway that will be developed for HE students in the "Algorithmic Bias" course;

- to set a common understanding about the purpose and learning goals of a learning pathway that will be developed for AE learners in the "Ethical AI microcredential";

- to set a common understanding about the purpose and learning goals of a learning pathway that will be developed for youth in the serious game on ethical AI.

These objectives contribute to the general objectives by setting the cornerstones for the following activities, allowing teachers, mentors and learners to have a clear vision of the goals for the different learning pathways, working to increase HE, Adult and Youth organisations capacity to provide learning opportunities that meet society needs but also are tailored to learners learning needs.

1.6. Expected results of the activities of WP2 and participants

1.6.1. Competency Matrix EQF 6 for "Algorithmic Bias" course (HE students) - Learning outcomes approach, 2 ECVS points, accreditation recommendations, pre-requirements for enrolling, contact hours, total workload, integration of EntreComp competences (eg.: Ethical and Sustainable Thinking), DigComp 2.0 competences (e.g.: Protecting health and well-being) and GrenComp competences (e.g.: Supporting fairness).

Competence Units:

CU1 - Algorithms Models and Limitations UIB

CU2 - Data Fairness and Bias in AI UA

CU3 - AI Privacy and convenience UA

CU4 - AI Ethics, a practical approach VAMK

CU5 - Case studies and project VAMK

1.6.2. Competency Matrix EQF 4 for the "Ethical AI micro credential" - Learning outcomes approach, ECVS points potential, accreditation recommendations, pre-requirements for enrolling, contact hours, total workload, integration of EntreComp competences (eg.: Ethical and Sustainable Thinking), DigComp 2.0 competences (e.g.: Protecting health and well-being) and GrenComp competences (e.g.: Supporting fairness).

Competence Units:

CU1 - What is Algorithmic Bias? HELIX

CU2 - Non-maleficience HELIX

CU3 – Accountability ITC

CU4 – Transparency ITC

CU5 - Human rights and fairness ITC

CU6 - AI Ethics, a practical approach HELIX

1.6.3. Learning Outcomes for Youth EQF 2 (serious game) - Featuring Learning outcomes approach, pre-requirements for enrolling, contact hours, integration of EntreComp competences (e.g.: Ethical and Sustainable Thinking), DigComp 2.0 competences (e.g.: Protecting health and well-being) and GrenComp competences (e.g.: Supporting fairness). General contents: Systemic inequalities in society, Basic mechanics of artificial intelligence systems, political agendas, AI impacts in the world.

2. Methodology

2.1. Objective:

The primary objective of this study was to garner insights from experts and stakeholders related to the "Charlie" project, which focuses on challenging biases in AI and big data applications. The intent was to understand their perspectives, knowledge, and feedback to further enhance the project's objectives and outcomes.

2.2. Study Design:

A cross-sectional study design was employed, utilizing an online questionnaire as the primary data collection tool.

2.3. Sample

Participants in the study were purposively selected based on their expertise or stakeholder status in the Charlie project. The sampling aimed to ensure a comprehensive representation from various sectors and roles within the project, capturing a wide array of viewpoints.

Out of the 9 respondents who provided their names, there is a slightly higher male representation, with 6 males and 3 females. This indicates a male-majority in the sample. However, it's essential to consider that 5 individuals did not reply, and their gender remains unknown. If we account for the entire potential respondent pool, including the non-respondents, males make up 40% (6 out of 15) and females 20% (3 out of 15). The gender of the remaining 33% is unknown.

The profile of the respondents, as gleaned from the institutional affiliations (10 out of 14 declare working as academic staff at Higher Education institutions), paints an interesting geographical and academic landscape. With a pronounced representation from Spain, nearly half of the respondents hail from institutions based in this country. Broadening the lens, the majority of the respondents are from Europe, with affiliations ranging from Poland, Finland, the Netherlands, Serbia and Denmark. The lone respondent from Brazil introduces an intercontinental dimension, indicating that the reach or relevance of the questionnaire isn't confined solely to Europe. This respondent might represent broader global interests or collaborations that intersect with the questionnaire's theme.

In summary, the respondent profile is predominantly European with a marked Spanish emphasis, interspersed with global representation and a hint of corporate interest, offering a multifaceted perspective on the questionnaire's reach and relevance.

2.4. Instrumentation:

An online questionnaire was meticulously crafted, integrating both closed-ended and open-ended questions. The questionnaire was designed to probe participants' understanding, experiences, and suggestions regarding biases in AI and big data as they relate to the Charlie project.

2.5. Administration:

The questionnaire was disseminated online and remained accessible from September 30th to October 16th. Participants received an initial invitation via email, along with a link to the questionnaire. Reminder emails were sent periodically to encourage maximum participation.

2.6. Data Analysis:

Upon closing the questionnaire, responses were collated and subjected to both qualitative and quantitative analyses. Descriptive statistics were used to summarize closed-ended responses, while thematic analysis was employed to interpret open-ended responses, extracting key themes and patterns.

2.7. Ethical Considerations:

All participants were informed about the purpose of the study and assured of the confidentiality of their responses. Participation was voluntary, with respondents having the option to withdraw at any point. Data was stored securely, with access restricted to the research team.

2.8. Limitations:

While the study sought comprehensive feedback, the reliance on self-reported data might introduce biases. Additionally, the purposive sampling method, though effective for the study's aims, may not capture the entire spectrum of opinions within the broader community engaged with AI and big data.

3. Results

3.1. General features of the document

3.1.1. Alignment between the matrices and the objectives of WP2

The majority of respondents believe that the competency matrices align extremely well with the specific objectives outlined, as indicated by the 9 respondents who selected this option. This represents a significant portion of the total feedback and suggests that most participants are satisfied with the alignment between the matrices and the objectives (see graph 1).

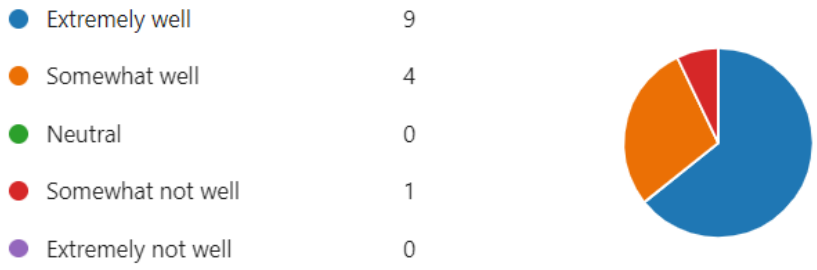
Additionally, a total of 4 respondents feel that the matrices align somewhat well, further reinforcing the general positive feedback about the competency matrices' alignment with objectives. This means that, combined, 13 out of the 14 respondents have a positive view of the matrices' alignment.

Only one participant indicated that the matrices align somewhat not well with the objectives. This represents a very small percentage of the overall feedback, indicating only a minor concern or possible area for improvement.

Interestingly, no respondents chose the "Neutral" or "Extremely not well" options. The absence of responses in these categories implies that there aren't any strong negative feelings towards the matrices, and no one is indifferent about the alignment.

Graph 1

Alignment between the matrices and the objectives of WP2



In conclusion, the overwhelming majority of respondents believe that the competency matrices provided align well, either extremely or somewhat, with the specific objectives outlined. There is minimal negative feedback, suggesting that, overall, the matrices are effective in meeting the set objectives.

3.1.2. Clarity of the document's written style

The standout point from the feedback is that the majority of respondents, 6 in total, find the document's written style to be "Very clear." This indicates that a significant portion of the participants deem the content to be straightforward and easily comprehensible. In addition to this, 3 individuals rated the written style as "Clear." When combined with the "Very clear" responses, it's evident that 9 out of the 14 participants view the document as having either a clear or very clear style, reflecting favourably on its comprehensibility.

Conversely, 4 respondents felt that the document's style was only "Somewhat clear." This suggests that, while the content might be understandable to an extent, there could be sections that might benefit from further elucidation. A singular respondent remained "Neutral" on the clarity of the document's written style, indicating neither particular clarity nor obscurity. This might point to an ambivalence or lack of strong sentiment regarding the document's clarity.

It's also noteworthy that no participants opted for the "Not clear" choice, which implies that the document doesn't pose significant comprehension challenges to the respondents.

Graph 2

Clarity of the document's written style

To conclude, the data suggests a general sentiment that the document's written style is clear, with a notable majority finding it exceptionally clear. While a handful of respondents believe there is room for some improvement, none felt the document was unclear, painting an overall positive picture of its comprehensibility.

3.1.3. Usability of the document format for reference and understanding

A significant observation is that the majority of respondents find the format of the document either "Usable" or "Very usable." Specifically, 6 respondents deemed the format "Usable" while 5 found it to be "Very usable." This indicates that a combined total of 11 out of the 14 respondents feel that the document's format facilitates easy referencing and understanding. On the other hand, a smaller portion of the respondents, totalling 2, felt that the format was only "Somewhat usable." This suggests that while these individuals didn't find major issues with the document's format, they did identify potential areas that could benefit from tweaks or improvements to enhance its usability.

Interestingly, only one respondent remained "Neutral" about the document's format usability. This could imply that this individual didn't have a strong inclination towards any particular assessment or perhaps felt that the format was neither especially usable nor problematic.

It's encouraging to note that no respondents found the document's format "Not usable." This is a positive indicator that the format doesn't pose significant challenges or obstacles to the respondents in terms of referencing or understanding the content.

Graph 3

Usability of the document format for reference and understanding

In conclusion, the data portrays a largely favourable perception of the document's format in terms of its usability for reference and understanding. While a few respondents have highlighted potential areas for improvement, the overall sentiment leans strongly towards the positive end of the usability spectrum. This suggests that the document format, in its current state, is effective in serving its purpose for the majority of its readers.

3.1.4. Gender inclusive language

A key observation is the substantial number of respondents who believe the document is quite inclusive in terms of gender representation. The category "Very inclusive" garnered the highest number of responses with 6 individuals. This suggests that a considerable portion of respondents feel that the document makes significant efforts to be gender-inclusive in its language and viewpoints.

Furthermore, 3 respondents rated the document as "Completely inclusive." This indicates that these individuals perceive the document as being exemplary in its commitment to gender inclusivity, without any noticeable lapses. The "Moderately" category saw 4 respondents. This represents a segment that believes the document makes a moderate effort in ensuring gender inclusivity but might still have room for improvement.

Only a singular respondent felt that the document was just "Slightly" inclusive. This might indicate a perception that, while the document has made some efforts toward gender-inclusive representation, there are still substantial areas where it could be enhanced. It's noteworthy that none of the respondents chose the "Not at all" option. This is an encouraging sign, as it indicates that none of the participants felt the document completely overlooked gender inclusivity.

Graph 4

Gender inclusive language

In summary, the data reveals a predominantly positive perception of the document's approach to gender-inclusive language and perspectives. While some respondents believe there is room for improvement, the overall sentiment is heavily tilted towards the belief that the document does a commendable job in ensuring gender representation.

3.1.5. Recommendations for document improvement regarding the previous characteristics

A total of 11 respondents answered an open question on potential improvements on the document formal characteristics. The evaluation of the document, based on the open feedback provided by multiple reviewers, has yielded several noteworthy insights:

Clarity & comprehensibility: A considerable portion of the feedback centred around the document's density and potential challenges in comprehension. Several respondents suggested the addition of practical examples, clearer phrasing of learning outcomes, and segmenting the document based on EQF levels to enhance clarity. Recommendations were made to improve the table of contents and address missing section titles.

Length & structure: Multiple reviewers expressed concerns about the document's length. Suggestions included the creation of a condensed version, restructuring based on EQF levels, and possibly splitting the document into multiple parts for ease of navigation.

Inclusivity & language: Gender-inclusivity emerged as a recurrent theme. Feedback indicated a perceived lack of balance in gender representation, with calls to emphasize non-binary genders and ensure broader gender representation.

Technical & terminology concerns: Some reviewers highlighted the technological jargon used, emphasizing the need for clearer definitions of key concepts. Concerns were raised about certain abbreviations and terms being introduced without adequate explanations.

3.2. Competency Matrix for EQF6 Level Target Group

3.2.1. To what extent is the learning outcomes approach clear and detailed for EQF6 level target group?

Out of 14 respondents, the majority (10) found the learning outcomes approach either "Completely" or "Very well" clear and detailed, indicating an overwhelmingly positive sentiment towards the matrix's clarity and detail for the EQF6 target group (see Graph 5). On the other hand, a minority view emerged from 3 respondents: 2 felt it was only "Slightly" clear and detailed, and 1 found it "Moderately" so. Additionally, 1 respondent opted not to review this aspect.

This consolidated feedback suggests that the learning outcomes approach is generally perceived as effectively tailored to the EQF6 target group. However, the concerns of the minority cannot be overlooked. Their feedback may be indicative of areas within the matrix that could benefit from finer detailing or enhanced clarity.

3.2.2. How comprehensive and relevant are the competency units, learning outcomes, skills, etc. for the "Algorithmic Bias" course?

In assessing the comprehensiveness and relevance of competency units for the "Algorithmic Bias" course, a significant majority (9 out of 14 respondents) indicated that they perceive the units as either "Completely" or "Very well" suited to the course's objectives (see Graph 5). This feedback underscores a dominant sentiment that the competency units are both exhaustive in their coverage and pertinent to the topic at hand. Contrastingly, a smaller subset of feedback provides a nuanced understanding. Specifically, 2 respondents felt the units were only "Slightly" comprehensive and relevant, while another opined they were "Moderately" so. Such feedback, although in the minority, could highlight potential areas or topics in the course that may benefit from further enhancement or refinement.

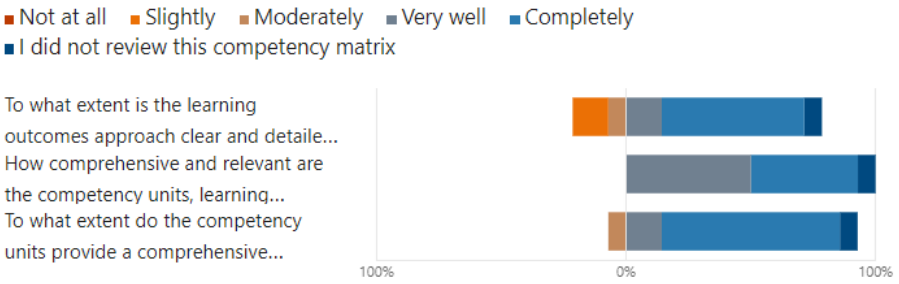
3.2.3. To what extent do the competency units provide a comprehensive understanding of the topics of the Charlie project for potential learners?

When it comes to the comprehensive understanding of the Charlie Project topics, an overwhelming majority, specifically 11 out of 14 respondents, conveyed confidence in the competency units. They expressed that these units either "Completely" or "Very well" impart a comprehensive understanding of the project topics (see Graph 5). This widespread approval suggests that the competency units are robust in their content coverage and provide learners with a holistic grasp of the Charlie Project's essence.

Yet, amidst this widespread consensus, there were voices that highlighted potential areas for improvement. One respondent specifically articulated that the understanding was only "Moderately" comprehensive. This feedback, though isolated, might be hinting at specific gaps or areas within the competency matrix that require refinement to cater more comprehensively to the EQF6 level target group's needs.

In conclusion, while the feedback largely underscores the competency matrix's effectiveness for the EQF6 level target group, the few contrasting opinions offer valuable directions for further refinements. These minority views, when heeded, can be instrumental in elevating the matrix's overall efficacy and inclusivity.

Graph 5



3.3. Competency Matrix for "Ethical AI microcredential" (EQF4 level)

3.3.1. To what extent is the learning outcomes approach clear and detailed for EQF4 level target group?

Out of the 14 respondents, a striking 6 found the learning outcomes approach "Completely" clear and detailed, while 3 rated it as "Very well" clear and detailed, and 1 felt it was "Moderately" so (see Graph 6). The dominant feedback indicates that the learning outcomes approach is exceptionally tailored to the EQF4 target group. The ratings of "Completely" and "Very well" combined make up a strong majority, suggesting that this aspect of the matrix has been well-received. The single "Moderately" rating, while in the minority, hints at potential areas for improvement.

3.3.2. How comprehensive and relevant are the competency units, learning outcomes, skills, etc. for the "Ethical AI microcredential"?

In evaluating the comprehensiveness and relevance of competency units for the "Ethical AI Microcredential" course, a significant majority of respondents signalled their approval. Specifically, 6 out of 14 conveyed that they perceive the competency units as "Completely" comprehensive and relevant, suggesting a robust alignment of the units with the course objectives. Additionally, 3 respondents felt the units captured the essence "Very well", further emphasizing the positive alignment.

However, the feedback also sheds light on areas that might require attention. One respondent found the units only "Moderately" comprehensive and relevant, indicating there might be specific elements within the course that could benefit from further detail or refinement.

3.3.3. To what extent do the competency units provide a comprehensive understanding of the topics of the Charlie project for potential learners?

In the context of comprehending the Charlie project topics, there is a predominant agreement among the respondents about the effectiveness of the competency units. Specifically, 6 out of 14 respondents are confident that these units provide a "Completely" comprehensive understanding of the topics. This is further bolstered by an additional 3 respondents who believe the understanding imparted is "Very well" comprehensive, suggesting that the competency units are largely successful in conveying the essence of the Charlie project.

However, amidst this consensus, there are voices that hint at potential refinements. One respondent, in particular, felt that the understanding was only "Moderately" comprehensive. This perspective, while in the minority, raises the possibility of certain gaps or areas within the competency matrix that could be enriched or detailed further to provide an even more robust understanding.

Graph 6

3.4. Competency Matrix for the serious game (EQF4 level)

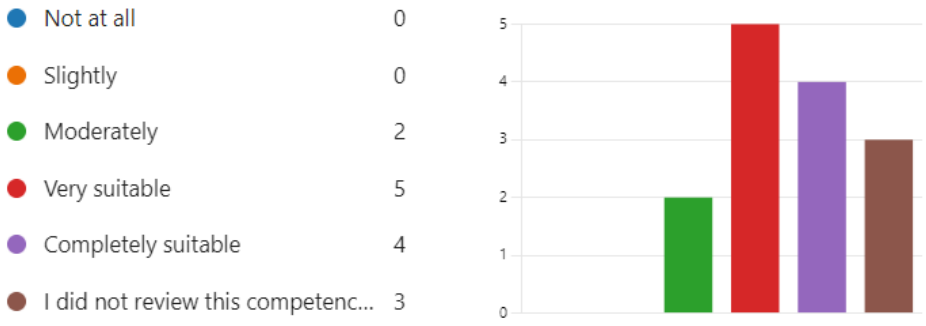
3.4.1. Suitability of learning outcomes in serious game format for youth demographic characteristics

In assessing the appropriateness of learning outcomes tailored for the youth demographic within a serious game format, the data illuminates a predominantly positive consensus among respondents. A combined majority, comprising 9 out of the 14 participants who provided feedback, ascertained that the learning outcomes are either 'Very suitable' (5 participants) or 'Completely suitable' (4 participants) for the targeted demographic. This underlines a strong belief in the efficacy of the game's educational objectives aligning with the expectations and needs of young users. Interestingly, a moderate sentiment was also observed, with 2 participants deeming the outcomes as 'Moderately' suitable. This highlights a space for potential refinement in aligning the game's educational objectives more precisely with the youth's preferences.

Notably, none of the respondents felt the need to categorize the learning outcomes as 'Not at all' or 'Slightly' suitable. This absence of negative feedback augments the notion of a broadly positive reception of the game's learning objectives.

Graph 7

Suitability of learning outcomes in serious game format for youth demographic characteristics



3.4.2. Reflectiveness of general contents in the matrix on youth's needs and interests concerning AI impacts and biases

In the process of gauging the alignment of the general contents presented in the matrix with the needs and interests of the youth on the subject of AI impacts and potential biases in algorithmic design, the findings indicate a mostly favourable reception. A significant proportion of respondents, amounting to 8 out of the 14 who offered feedback, opined that the contents are 'Very reflective' of the target audience's concerns. This reinforces the notion that the matrix has largely managed to resonate with the youth's perspectives and curiosities about the intricacies of AI.

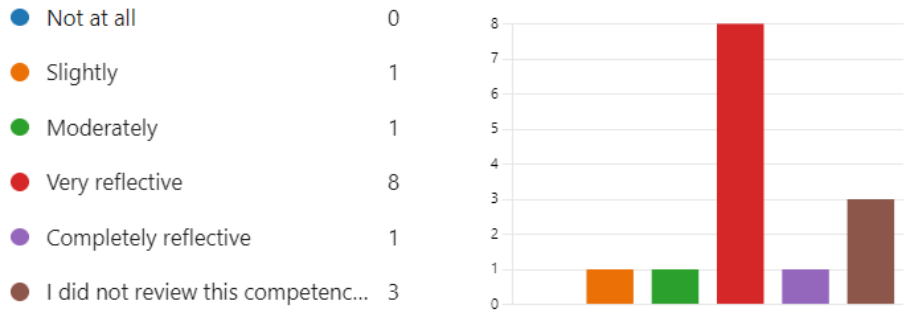
Contrastingly, the 'Completely reflective' category garnered only a single affirmation, suggesting that while the matrix has been successful to a large extent, there might still be areas that haven't fully encapsulated the entirety of the youth's concerns. A minority sentiment was observed in the 'Slightly' and 'Moderately' reflective categories, each receiving a singular vote. These responses point towards

certain gaps or potential areas of enhancement in the matrix's content that might better cater to the young demographics' viewpoints.

It's noteworthy that none of the participants felt that the matrix was 'Not at all' reflective, indicating an absence of strong negative sentiment and underscoring the general effectiveness of the matrix in addressing AI-related concerns of the youth.

Graph 8

Reflectiveness of general contents of the EQF4 matrix and learning outputs



3.5. General remarks

3.5.1. Clarity of vision in competency matrices for learning pathways goals

In evaluating the efficacy of the competency matrices in conveying a distinct vision for the objectives of varied learning pathways, the feedback received is predominantly positive. A majority of respondents, encapsulating 8 out of the 14 participants, believe that the matrices fulfil this function 'Extremely well'. This significant endorsement underscores the matrices' ability to lucidly define and present the desired outcomes for different learning trajectories.

Furthermore, an additional 4 participants opined that the matrices perform 'Somewhat well' in this capacity. While this indicates a generally favourable view, it also suggests that there might be room for slight improvements to make the matrices' vision even clearer for all users. It's notable that only a single participant offered a 'Neutral' stance. This might hint at some level of ambivalence or perhaps a need for further elaboration in certain areas of the matrices. Similarly, a single respondent felt that the matrices convey the vision 'Somewhat not well', hinting at potential areas that might require refinement or further clarity. Encouragingly, none of the participants felt that the matrices did not promote a clear vision 'At all', indicating a lack of strong negative sentiment towards the matrices' design and content.

In summation, the data suggests that the competency matrices are largely successful in providing a transparent and comprehensible vision of the goals tailored for various learning pathways. However, the minor feedback on potential improvements signals the continuous evolution and refinement that such matrices might undergo for optimal clarity.

Graph 9

Clarity of vision in competency matrices for learning pathways goals

3.5.2. Open commentaries to the matrixes of competences in general

The feedback received regarding the competency matrices is diverse, encompassing both positive accolades and constructive criticism. Here's an aggregation and assessment of the comments:

Relevance and timeliness: The first comment underscores the rapid evolution inherent to fields like AI, algorithms, and big data. The suggestion for regular review cycles to ensure the matrices' continued relevance resonates with the dynamic nature of these areas. This proactive approach can keep the content timely and beneficial for users.

Language consistency: The importance of maintaining a uniform English style, be it UK or US, is stressed. Inconsistencies in style, spelling, or punctuation can diminish the professionalism of the document.

Document complexity: Some feedback indicates that the document might benefit from simplification. Descriptors like "convoluted" and "dense" suggest the need for more straightforward and digestible content.

Visual enhancements: Introducing graphics and images is proposed to make the document more dynamic and visually engaging, facilitating a more enjoyable and understandable reading experience.

Usability and practicality: While one comment praises the matrices for promoting a clear vision, it also highlights a potential enhancement. Incorporating practical examples could illuminate how learning pathways can be applied, especially for educators. Such tangible insights could enhance the matrices' practicality.

4. Conclusions

In light of the feedback on the competency matrices, in general terms, and the associated documentation, there is a prevailing sentiment of satisfaction among the respondents. An analysis of the data reveals four main takeaways:

Alignment with objectives: The competency matrices have been predominantly well-received. The vast majority of respondents find that these matrices align well with the set objectives. Such a positive reception signals that the matrices effectively encapsulate and represent the intended goals. This strong alignment is pivotal for the matrices to serve their purpose effectively.

Clarity of written style: The document's written style stands out in terms of its clarity. An overwhelming majority of respondents attest to its exceptional lucidity. While there's always room for enhancement in any document, it's noteworthy that not a single respondent found the document unclear. This indicates a high level of effort and precision in drafting the document to ensure it's comprehensible to its readers.

Format and usability: The document's format, crucial for its reference and understanding, has been perceived as largely user-friendly. A few suggestions for improvement were noted, but these were overshadowed by the overwhelmingly positive feedback. The format's effectiveness is indicative of its potential to serve as a reliable and user-friendly resource for its target audience.

Gender-inclusive approach: In today's world, the importance of gender-inclusive language and perspectives cannot be overstated. The document has been commended for its approach in this domain. While there's always room to evolve and adapt, the general consensus is that the document does a laudable job in ensuring fair gender representation.

In essence, the feedback underscores the document's strengths in alignment with objectives, clarity, format, and gender inclusivity. The occasional suggestions for improvement are but natural and provide avenues for further refinement. Nevertheless, the overarching sentiment is one of appreciation and recognition of the document's effectiveness in meeting its intended goals.

If we focus our attention in the Competency Matrix for EQF6 Level Target Group, the overarching feedback indicates a strong satisfaction with the clarity and detailing of the learning outcomes approach tailored to the EQF6 level target group. A substantial majority (10 out of 14 respondents) found the learning outcomes approach to be either "Completely" or "Very well" articulated. This underscores the matrix's effectiveness in communicating its intentions transparently and comprehensively to its intended audience. However, the perspectives of 3 respondents, who found the approach to be less clear and detailed, serve as crucial pointers towards potential areas that might benefit from further refinement. Their concerns, although in the minority, offer a valuable insight into ensuring the matrix is universally comprehensible.

The feedback concerning the "Algorithmic Bias" course is indicative of a broad consensus regarding the competency units' comprehensiveness and relevance. With 9 out of 14 respondents resonating with the view that the competency units are either "Completely" or "Very well" suited to the course's objectives, it is evident that the matrix has been successful in encompassing the essential elements pertinent to the course. Yet, the feedback from the 3 respondents, who felt the units could be more comprehensive and relevant, should not be overshadowed. Their perspective could be pointing towards certain nuances or topics within the course that may need more detailed attention.

The competency units related to the Charlie Project have received a robust endorsement, with a remarkable 11 out of 14 respondents expressing that these units provide either a "Completely" or "Very well" rounded understanding of the project topics. This feedback signifies the competency matrix's capacity to furnish learners with a well-rounded perspective on the Charlie Project. However, the perspective of the respondent who felt the understanding was only "Moderately" comprehensive shouldn't be disregarded. Such feedback can help in identifying and bridging potential gaps in the matrix, ensuring it meets the diverse learning needs of the EQF6 level target group.

In sum, the feedback paints a largely positive picture of the competency matrix tailored for the EQF6 level target group. The matrix, in its current form, seems to effectively cater to the majority's learning needs, offering clarity, relevance, and a comprehensive understanding of the subjects at hand. However, the contrasting views from a few respondents serve as a reminder of the continual evolution needed in educational tools. These minority perspectives, rich in insights, can guide further iterations of the matrix, making it even more refined, inclusive, and effective for its intended audience.

If we analyse the results on the review of the competency Matrix for "Ethical AI microcredential" (EQF4 level) the feedback received for the learning outcomes approach tailored to the EQF4 level target group is prominently favourable. With 9 out of 14 respondents finding the learning outcomes approach either "Completely" or "Very well" articulated, it is evident that the matrix adeptly communicates its intentions to its intended audience. This signifies that the matrix has been meticulously crafted, keeping in mind the clarity and detailing needed for the EQF4 level. However, the perspective of the single respondent who found it "Moderately" clear and detailed serves as a valuable beacon, pointing towards areas that might warrant further elaboration or clarification.

In the realm of the "Ethical AI Microcredential" course, the feedback underscores a predominant satisfaction with the competency units' comprehensiveness and relevance. A collective 9 out of 14 respondents feel that the competency units are either "Completely" or "Very well" aligned with the course's objectives, which showcases the matrix's efficacy in encapsulating the essence of the course. However, the feedback from the respondent who found the units only "Moderately" comprehensive and relevant is enlightening. It suggests that while the matrix is largely effective, there are nuances that could be honed further to enhance its relevance and coverage.

When assessing the competency units concerning the Charlie Project, the feedback mirrors a robust confidence in the matrix's ability to provide a comprehensive understanding of the project topics. The combined feedback from 9 out of 14 respondents, who believe the competency units offer a "Completely" or "Very well" rounded understanding, is a testament to the matrix's efficacy in this regard. Nevertheless, the viewpoint of the respondent who felt the understanding was only "Moderately" comprehensive is invaluable. Such feedback can act as a guide, highlighting potential areas that might benefit from further detailing or enrichment.

In summation, the feedback on the Competency Matrix for the "Ethical AI microcredential" (EQF4 level) paints a predominantly positive landscape. The matrix, in its current rendition, seems to adeptly cater to the EQF4 level target group, offering clarity, relevance, and a well-rounded understanding of

the topics in focus. However, the occasional feedback suggesting potential refinements is a reminder of the matrix's evolutionary journey. These insights, although from a minority, can serve as catalysts in refining the matrix further, ensuring it is universally effective and comprehensive for its intended audience.

Regarding the review of the Competency matrix for the serious game (EQF4 level), the feedback received underscores a prevalent satisfaction with the learning outcomes designed for the youth demographic within the serious game format. With 9 out of 14 respondents finding the learning outcomes either 'Very suitable' or 'Completely suitable', it is evident that the game has been largely successful in bridging its educational objectives with the expectations of its young audience. The nuanced feedback from the 2 respondents who deemed it 'Moderately' suitable offers a unique lens into areas that might be honed further to cater more effectively to the youth's preferences. Interestingly, the lack of negative feedback in the 'Not at all' or 'Slightly' suitable categories further reinforces the game's overall positive reception, emphasizing its alignment with youth expectations.

The feedback highlights a predominant resonance of the matrix's general content with the youth's interests and concerns regarding AI impacts and biases. A commendable 8 out of 14 respondents believe that the matrix's content is 'Very reflective' of the youth's needs, suggesting that the matrix effectively captures the youth's curiosities and concerns about AI. However, the singular affirmations in the 'Completely reflective', 'Slightly reflective', and 'Moderately reflective' categories point towards a spectrum of opinions. While the matrix has been largely effective, these feedbacks indicate there's still room for capturing a fuller spectrum of the youth's concerns. The absence of feedback in the 'Not at all reflective' category is a testament to the general belief in the matrix's efficacy in portraying AI-related concerns relevant to the youth.

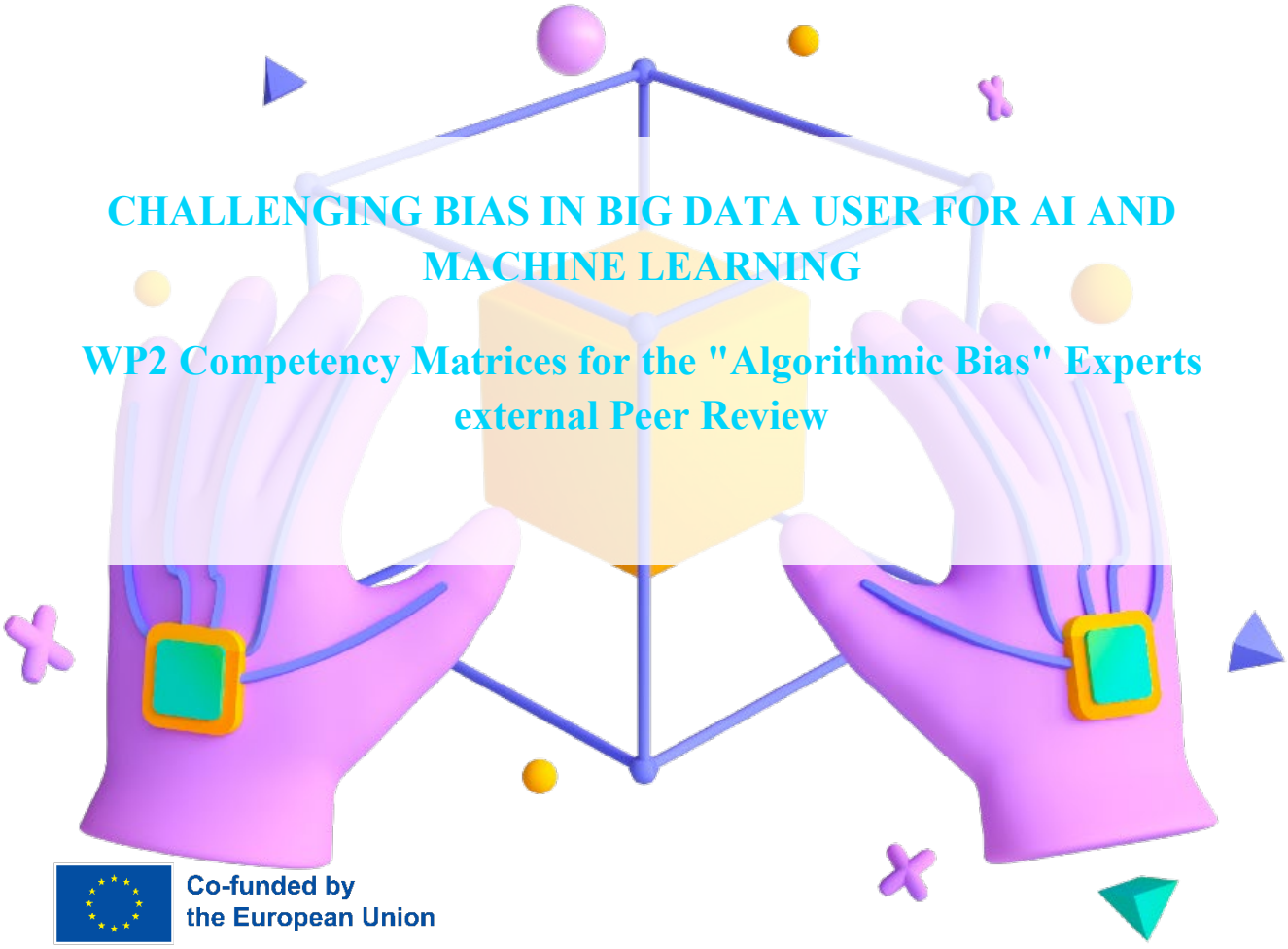
In assessing the clarity and vision conveyed by the competency matrices for diverse learning pathways, the overarching sentiment among respondents is undeniably positive. A substantial majority recognizes the matrices' proficiency in lucidly outlining the objectives of different learning trajectories. This significant endorsement speaks volumes about the matrices' design, which effectively captures and communicates the intended learning outcomes.

However, every feedback, whether from the majority or minority, provides a lens into the user's experience. While many respondents resonate with the matrices' vision, a segment perceives potential areas for refinement. These nuanced viewpoints, though few in number, are invaluable. They hint at the subtle intricacies and improvements that can make the matrices even more user-centric. The 'Neutral' and 'Somewhat not well' perspectives, in particular, offer opportunities for introspection and improvement. They suggest that while the matrices are largely effective, there's always room to evolve and better cater to the diverse learning needs of every user. Encouragingly, the absence of any strong negative sentiment is a testament to the matrices' foundational strength. No respondent felt that the matrices entirely missed the mark, which underlines their overall effectiveness.

In essence, the competency matrices showcase a commendable ability to provide a transparent and comprehensible vision for varied learning pathways. While they excel in their current rendition, the feedback underscores the importance of continuous iteration. Embracing this feedback will ensure that the matrices remain dynamic, evolving consistently to meet the ever-changing needs of their users.

CHALLENGING BIAS IN BIG DATA USER FOR AI AND MACHINE LEARNING

WP2 Competency Matrices for the "Algorithmic Bias" Experts external Peer Review



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