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Development and Validation of an Instrument for Measuring Equality, Diversity and Inclusivity (EDI) in Medical Education Teaching Resources: The GRADES10

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ABSTRACT

Higher education institutions around the world have a responsibility to diversify their course content. This is an important consideration to ensure that students are prepared to serve a diverse population once they graduate, however, a lack of diversity representation in medical school curricula in particular, is reported in the literature. A paucity of reliable resources to support creating more inclusive content is also reported. This study developed and validated a diversity measurement instrument, designed to look at representation in the areas of gender, religion, age, disability, ethnicity/race, sexuality, and socio-economic status. Early prototypes were sent to experts for validity testing and using their feedback, improvements and iterations were made to the instrument until the final instrument was agreed: the GRADES10©. The instrument was then applied to a variety of medical education resources to test for rater-reliability. An accompanying user guide was developed to support users with the application of the GRADES10© in practice. Face validity was conducted by 10 experts on several iterations of the instrument from the early prototype (GRADESs7), until the final agreed GRADES10©. Rater-reliability was calculated by intraclass correlation coefficient (ICC) and Cronbach's Alpha measure of internal consistency. The GRADES10© instrument was shown to have an ICC of 0.83% (SD 0.725–0.907) $p = < .0001$, and Cronbach's Alpha of 0.97. Overall, this study has shown that the validated GRADES10© instrument is able to measure diversity in medical teaching resources reliably. The GRADES10© has the potential to contribute to creating a more inclusive learning environment by allowing its users to apply a diversity metric to their educational materials, to identify gaps and areas for improvement. If applied by medical schools and organisations offering continuing medical education courses in future, the GRADES10© may impact the grassroots of medical education diversification, which may have a beneficial effect on medical student and doctors' attitudes, experiences and ultimately on patient care.

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Introduction

Equality, diversity and inclusivity (EDI) considerations in undergraduate healthcare education and in Continuing Medical Education (CME) are increasingly recognised as crucial for addressing healthcare disparities, improving health outcomes and fostering an inclusive medical community, at a time when there is greater focus on the social accountability of educational programs to the communities and individuals in which medical professionals serve [1], [1–3]. Addressing disparities in curriculum representation and promoting diversity within teaching faculties are essential for equipping future healthcare professionals with the skills to provide culturally competent care and navigate diverse patient populations effectively [2].

Education and exposure to diversity representation can help health care staff and undergraduate students, to recognise their own biases in order to improve health care delivery [4]. Higher education institutions therefore have a responsibility to offer an adequate level of diversity in their course content, to ensure that students are prepared to serve diverse populations once they graduate [5]. Being prepared to serve a diverse population is one of the General Medical Council's (GMC) expectations for doctors, who have a duty to care for and treat all patients equitably and according to their Equality, Diversity and Inclusion strategy [6] the GMC "value the diversity within the medical profession and recognise the importance of supporting doctors to serve a diverse population across the UK" [6].

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In line with GMC expectations, the UK Medical Schools Council (MSC) advocate increased diversity in medical education and provide some guidance on how this should be done. According to their Active Inclusion Framework [7] there are several activities that medical schools should be doing to challenge exclusion and promote active inclusion, and these include being accountable, monitoring protected characteristics data, challenging exclusion during recruitment, selection and placements, implementing mechanisms of support and challenging the curriculum [7]. There is extensive evidence that students with protected characteristics face disproportionate challenges whilst at medical school [7,8] and further evidence that diversity enriches learning [9] and an inclusive learning environment leads to better doctors overall [10].

Despite the GMC recommendations [6,7], there is no universal system for indexing diversity activities to give an overarching diversity score for each medical school. Developing a Medical Schools Diversity Index may prove useful in future because a diversity index can help teams and organisations acquire insight into their current level of diversity [11] represented during admissions, within the senior leadership team, and within the grass roots of program delivery [11]. With this in mind, targeting diversity from the bottom up, allows for direct and immediate impact on students' experiences and attitudes [12–14]. Incorporating diverse perspectives into everyday education can shape a students' attitude in tangible ways [12]. Indeed, medical schools around the world have been increasing their efforts to be more representative to keep up with the diversity of their patient populations [15] with an increasing number of studies looking into the representation and inclusivity of curricular content in particular [16–21]. Furthermore, one of the recommendations from the MSC is for the audit of teaching materials and assessments, to ensure they cover diversity appropriately (MSC, 2021, p.16).

To our knowledge, there is no universal tool to support EDI auditing activity, such as that recommended by the MSC. To have an idea of the level of diversity representation in undergraduate and CME course materials, a standardised way to measure EDI is thus required [22,23]. The aim of this study was 1. to ascertain whether EDI can reliably be measured within teaching resources, and 2. develop and validate an EDI assessment tool. The study sought to develop a tool which outlines clear definitions of EDI, challenges misconceptions, improves interpretation and reduces subjectiveness of EDI resources and offers a metric of EDI measurement. A further aim was to develop a tool which medical schools and organisations offering CME, can apply to a multitude of educational resources, which in turn will allow for benchmarking activity, tracking, quality improvement through reassessment, improving accountability of the academic team and school/organisation and thereby contributing to the wider EDI agenda. This study did not require approval from the local Ethics committee due to there being no human data required.

Methods

Tool Development

Taking inspiration from the Gender Bias14 Tool [24], a prototype of a new EDI tool was developed. The categories the tool aimed to measure were based on recognised types of diversity as enshrined in the Equality Act 2010 [25] and AHS [26] and included race, ethnicity, gender, gender identity, sexual orientation, age, social class, disability and religious or ethical values. These categories were then reordered as Gender, Religion, Age, Disability, Ethnicity/Race, Sexuality, and Socio-economic status, to generate a useful acronym for the tool: G.R.A.D.E.S. Inclusion of these categories was based on the idea that in the UK, the absence of these protected characteristics represents privilege, or in other words, the absence of obstacles or negative experiences that a person of protected characteristics may experience [27–29]. Based on the initial prototype, the tool was given the title "GRADES7", because at that stage, there were seven aspects of measurement.

The GRADES tool focused specifically on the level of diversity representation, however, during piloting it became apparent that positive and negative representation was an important omission. *Positive representation* is the depiction of a person in a way that is enhancing to them – a picture, image or description which portrays a person in a favourable, empowering and positive way, for example, a fit athlete, someone eating a healthy diet, someone who is a role-model of some kind. Anything which shows the person in a good light that is positive and inspirational [30].

Conversely, *negative representation* is the depiction of a person in a way that reinforces harmful or degrading stereotypes. It may be an image, or the derogatory description of a person or a context within the text. This may include things like images of a black youth being arrested, a woman depicted as a homemaker and caregiver, or narrative descriptions using derogatory language such as: referring to someone as a cripple, as being gay, or fat and which is generally harmful [31]

Differentiating between positive and negative representation on top of overall diversity representation was a crucial addition to the GRADES tool, to ensure that teaching resources would be graded using accurate and fair representation that does not reinforce harmful stereotypes.

Lastly, to mitigate for the variation in the length of different medical teaching resources, the tool was further designed to look at the *number of instances* of positive and negative "privileged" representation versus positive and negative "underprivileged" representation [27–29]. This way, within each resource being measured, a ratio of *privileged* - to - *underprivileged* could be made, giving a percentage result, and thereby erasing the length of the resource as a factor.

Validity Testing

The GRADES tool prototype and a user guide were sent to experts for face validity testing. Over a period of 2 months, the GRADES tool was iteratively developed based on expert feedback until eventually the final version was agreed upon: The GRADES10©. The original tools' 7 key attributes were uplifted to 10, in order to separate out gender (to include male, female, other) as well as to separate physical vs mental disability. The expert panel of 10 face validators included librarians, academics and Equity, Diversity, Inclusivity (EDI) staff representatives from across two separate Universities.

A list of questions (Table 1) was sent along with the GRADES7/8/9 and finally 10, to help experts provide focused and detailed feedback.

User Guide Development

Developing a detailed user guide was a significant step to ensure the reliability of this tool and to achieve standardisation of results. The user guide details instructions on how to use the tool, how to interpret the results and act on them, examples to clarify ambiguities, definitions to support the understanding of technical terminology and a demonstration of how to use the tool on an example set of lecture slides. Providing this type of guidance was crucial to ensure the tool gave standardised results based on standardised application. The User Guide is provided at suppl1

Table 1. Face validity testing of GRADES7–9 prototypes.

	Face Validity Questions
1	Does the user guide make sense?
2	Is the GRADES tool easy to use/user friendly?
3	Are the questions in each section understandable/well worded?
4	Do you think the tool measures bias accurately?
5	Do you think the tool outcome scores are useful?
6	Is there anything which could improve it?
7	Anything EDI related missing?
8	Would you use this tool in your everyday practice?

The GRADES10©

The GRADES10© tool uses a combination of colour coding, figures and charts to make the data more easily interpretable at a glance. Users are only required to enter data into the Primary Data Table (PDT) (Table 2), after which the visual figures and charts are automatically generated.

The PDT is colour coded as follows: Purple for Gender; Dark Blue for Religious affiliation; Brown for Age; Green for Disability, Light Blue for Ethnicity; Pink for Sexuality and Yellow for Socioeconomic Status. Users are required to impute their "counts" in each section. For example, the number of women portrayed in a positive light, would be entered into the first purple row of the PDT. The number of women portrayed in a negative light, would be entered into the second purple row. The number of persons with an obvious disability, portrayed in a positive light, would be entered into the first green row, and so on, until all counts are added for all sections. At the bottom of each section, the % *proportion* of representation is given. For example, if the proportion of women/girls is given as 38%, then the resource being graded has an overall female representation of 38%. It should be noted that this proportion does not tell the user whether this is positive or negative representation, so the user must look at each count, or, look at the representation bias figure which is autogenerated (Figure 1) to determine how much of the 38% was above the zero line, in other words, in the positive direction.

To avoid tendency to search for, interpret, favour or evaluate new information in a way that is consistent with existingThis lecture was selectedbeliefs or values, otherwise known as confirmation bias [32] in interpreting images and text using GRADES10©, it is recommended that users score medical education resources in teams, rather than as individuals, so that mutual decisions are taken as to whether the item is to be graded as positive, or negative, within the educational context. The use of bracketing is recommended and is described in more depth in the user guide (Suppl1).

Table 2. GRADES10© primary data table.

Gender: cisgender women and girls	
Number of cisgender women and girls represented positively	4
Number of cisgender women and girls represented negatively	1
Gender: transgender, agender, pangender, genderfluid, etc... (gender minorities)	
Number of transgender, agender, pangender, genderfluid, etc... (gender minorities) individuals represented positively	1
Number of transgender, agender, pangender, genderfluid, etc... (gender minorities) individuals represented negatively	1
Gender: cisgender men and boys	
Number of cisgender men and boys representated positively	6
Number of cisgender men and boys representated negatively	2
Proportion of representation of cisgender women and girls	38%
Proportion of representation of transgender, agender, pangender, genderfluid, etc...(gender minorities) individuals	13%
Religion	
Number of individuals with other religious affiliations represented positively	1
Number of individuals with other religious affiliations represented negatively	0
Number of Christian and atheist individuals represented	2
Proportion of representation of other reliigous affiliations	33%
Age	
Number of individuals aged 40 or over represented positively	3
Number of individuals aged 40 or over represented negatively	1
Number of individuals aged 18-39 represented	3
Proportion of representation of individuals aged 40 or over	57%
Physical Disability	
Number of individuals with a physical disability represented positively	1
Number of individuals with a physical disability represented negatively	0
Mental Disability	
Number of individuals with a mental disability (including learning difficulties) represented positively	0
Number of individuals with a mental disability (including learning difficulties) represented negatively	1
Estimated proportion of representation of individuals with a disability	12%
Ethnicity / Race	
Number of individuals who are non-white and/or from traditionally underprivileged ethnic backgrounds represented positively	8
Number of individuals who are non-white and/or from traditionally underprivileged ethnic backgrounds represented negatively	2
Number of white individuals from traditionally privileged ethnic backgrounds represented	6
Proportion of representation of individuals who are non-white and/or from traditionally underprivileged ethnic backgrounds	63%
Sexuality	
Number of homosexual, bisexual, asexual, etc...(not heterosexual) individuals represented positively	3
Number of homosexual, bisexual, asexual, etc...(not heterosexual) individuals represented negatively	2
Number of heterosexual individuals represented	2
Proportion of representation of homosexual, bisexual, asexual, etc...(not heterosexual) individuals	71%
Social Economic Status (SES)	
Number of individuals from lower SES backgrounds represented positively	1
Number of individuals from lower SES backgrounds represented negatively	3
Number of individuals from higher SES backgrounds represented	0
Proportion of representation of individuals from lower SES backgrounds	100%

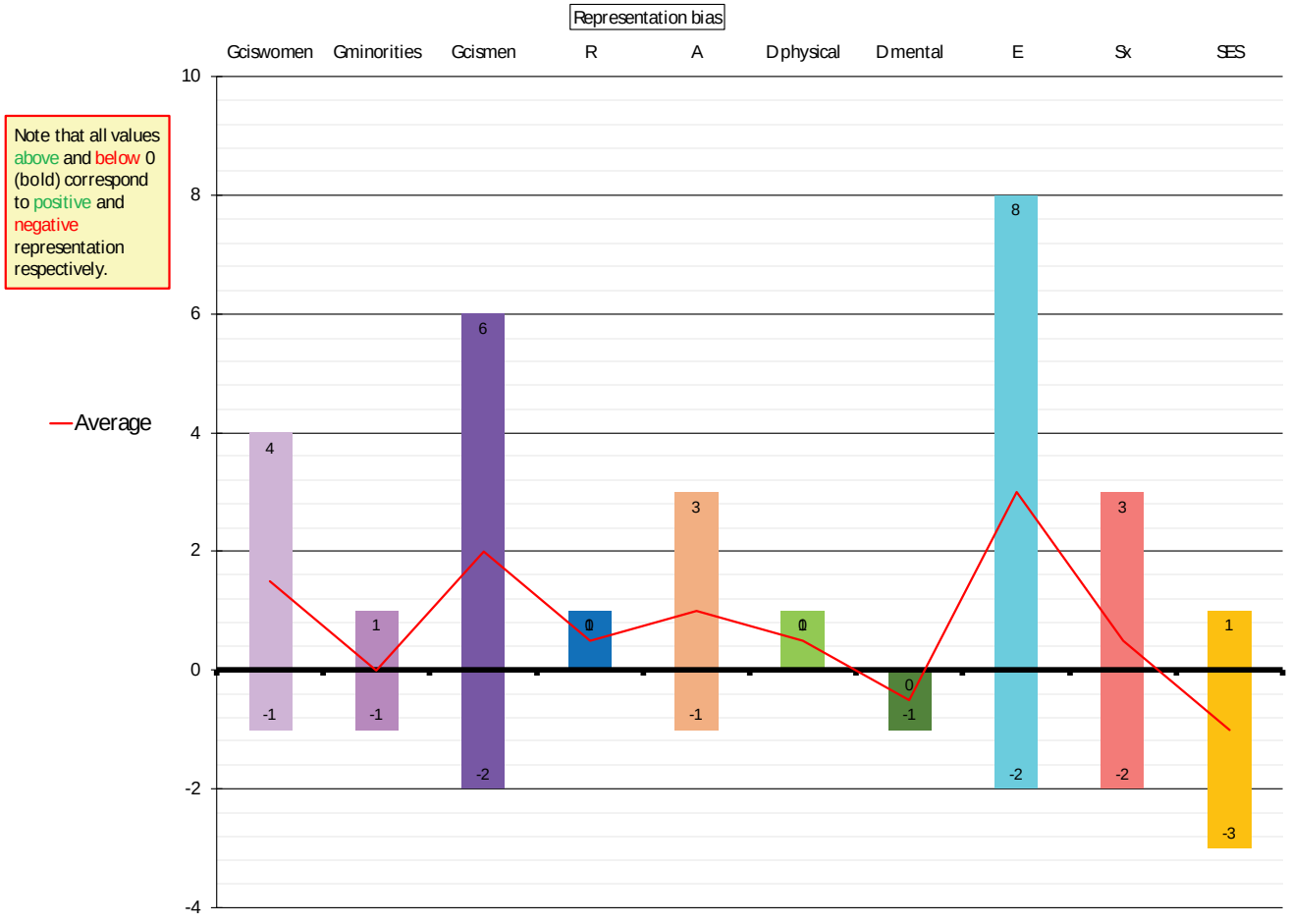

Figure 1. Bar chart showing negative or positive representation within each GRADES category.

Table 3. Overall positive vs negative representation.

	Positive Rep	Nega!ve Rep	Avera ge
Gciswomen	4	-1	1.5
Gminori!es	1	-1	0
Gcismen	6	-2	2
R	1	0	0.5
A	3	-1	1
D physical	1	0	0.5
D mental	0	-1	-0.5
E	8	-2	3
Sx	3	-2	0.5
SES	1	-3	-1
Overall:			7.5

The ratio of positive to negative representation is automatically displayed upon completion of the PDT (Table 3). If the overall representation is predominantly positive, the score will be green, however, if predominantly negative, the score will be red.

For resources to be graded as more positive than negative, this result needs to be green. This outcome is visually displayed in addition to numerically displayed, giving the user an immediate visual representation of how positive or negative the teaching resource is. For a truly positively inclusive and diverse resource, users should aim for the majority of the coloured bars to appear above the zero line (Figure 1).

!"#$

EDI is measured by GRADES10© in terms of comparing representation of attributes of traditional "privilege" to "underprivilege". A person described as "privileged" in this sense, means that they are defined as: young (< 40 yrs), white, hold atheist or Christian values, are from a middle-class background, are able-bodied, heterosexual and male (according to their biological characteristics at birth). A person described as "underprivileged", is essentially anyone with attributes other than those given as "privileged".

Table 4. % EDI score (privilege versus underprivilege).

	Tradi onally privileged Representa on	Tradi onally underprivileged Representa on	Diversity Rep Propor on
Gcis.	8	5	38%
Gminori es	13	2	13%
R	2	1	33%
A	3	4	57%
D	15	2	12%
E	6	10	63%
Sx	2	5	71%
SES	0	4	100%
Average:			48%

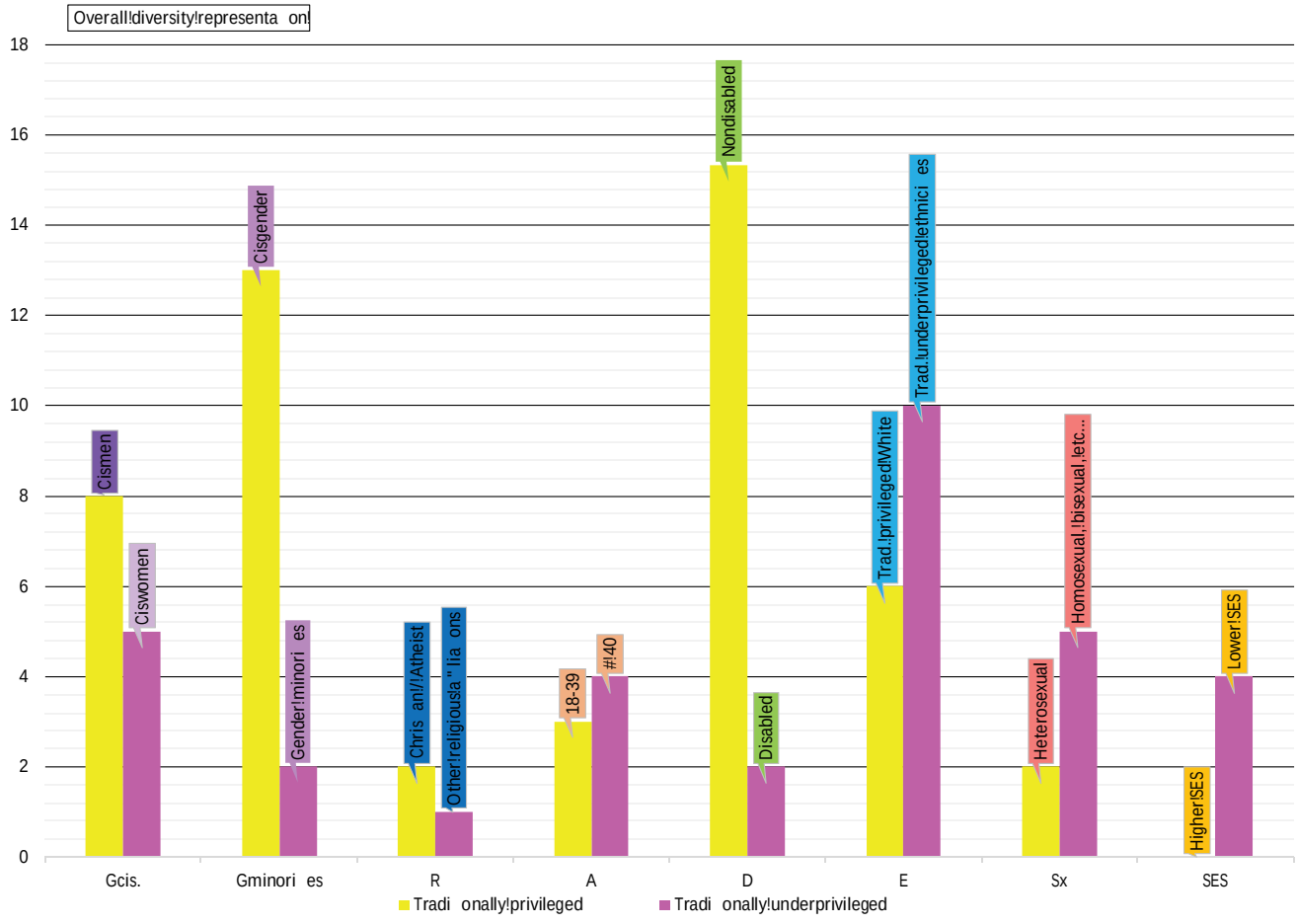

Figure 2. Visual representation of how much the resource represents the traditionally underprivileged (pink) vs the traditionally privileged (yellow).

GRADES10© gives a % figure for how diverse and inclusive each category is, with an overall percentage EDI score (Table 4). It is important to compare this to the accompanying figure (Figure 2) which gives the user an immediate visual representation of exactly how the overall EDI % is calculated. This visual enables the user to determine in which of the GRADES10© categories there is EDI representation and by how much. In the example given in Table 4, there is an almost 50% ($n = 48\%$) EDI score. The visual output in Figure 2 allows users to determine exactly which of the GRADES categories is represented and which are not.

Inter-Rater Reliability Testing

The GRADES10© package including the tool, the user-guide, and a demonstration of how to use the tool were sent to 6 raters along with a set of lecture slides titled

"The Patient Narrative" [33]. This lecture was selected because it contained a variety of content to analyse including both text and images and was short enough not be too overwhelming and time consuming for the interrater participants. The participants were in an environment with minimal distractions and were asked to use the tool and user guide independently. Rater scores were collated and analysed statistically to generate rater-reliability scores.

Statistical Analysis

The rater data (the GRADES10© scores) were collated for statistical analysis in SPSS [34]. As there were multiple raters and the data was continuous, Intraclass Correlation Coefficient (two-way mixed model looking at consistency rather than absolute agreement) was used for the interrater analysis [35]. In addition, Cronbach's alpha was calculated to determine whether the items were consistently measuring the intended concept of diversity, across different users [36].

Results

Face-Validity

With feedback gathered from 10 experts, adjustments were made to improve the tool through 4 iterations until the final GRADES10© version was agreed. The main iterative changes are described in Table 5. These changes were important as they were in response to specific uncertainties raised by the experts and helped to ensure the tool gave optimal standardised results.

Interrater Reliability

ICC estimates and their 95% confident intervals were calculated using SPSS statistical package version 29 [34] based on single measurement, consistency, 2-way mixed-effects model. From the 6 datasets, it was determined that ICC was 0.83 (0.725–0.907) $p = < .001$. According to Koo and Li [35], this indicates good reliability as it falls between 0.75 and 0.90.

Table 6 shows the correlation between raters. The lowest level of correlation is .858 with the majority being > .90.

Cronbach's alpha provides a measure of internal consistency or degree of *inter-item* correlation [37]. The GRADES10© value for Cronbach's Alpha was a = .97 indicating excellent internal consistency as being > than a = .90 [38].

Overall, by using appropriate and rigorous mechanisms of validation and reliability testing, the GRADES10© demonstrates good reliability and excellent internal consistency.

Discussion

To date, most studies measuring diversity in medical curricula have been conducted without a standardised tool to measure diversity reliably and track and compare progress, with many failing to look at both text

Table 5. GRADES 6–10 alterations following expert feedback.

Face Validity: Main changes made
Preface the user guide by explaining the importance of diversity representation to raise awareness.
Clarify what changes should be made if the tool's results indicate a lack of diversity.
Provide further instructions on how to prevent unconscious bias.
Provide more examples where positive and negative feedback are not explicit.
Review the terminology used in the tool to make it more appropriate.
Add a feature to easily reset the tool after use.
Provide a demonstration of how the tool should be used.

Table 6. Inter-rater correlation.

Inter-Rater Correlation						
	Rater1	Rater2	Rater3	Rater4	Rater5	Rater6
Rater1	1.000	.994	.966	.982	.988	.893
Rater2	.994	1.000	.957	.978	.993	.863
Rater3	.966	.957	1.000	.923	.939	.910
Rater4	.982	.978	.923	1.000	.977	.903
Rater5	.988	.993	.939	.977	1.000	.858
Rater6	.893	.863	.910	.903	.858	1.000

and images [16–21]. The GRADES10© tool seeks to offer a validated mechanism for undertaking this activity in a standardised way. The GRADES10© could be used to track the progression of diversity and inclusivity within teaching materials and for numerical and visual comparison between different resources and between subsections of curricula. Overall, with the application of the GRADES10© tool, module leads and academics would be able to make the appropriate adjustments to improve diversity representation throughout reading lists and teaching materials. In turn, increased exposure to diverse resources during education could improve overall student attitudes, and in turn, their healthcare delivery [4,5,7,9,10]. Lastly, because the GRADES10© offers a visual and immediately interpretable impression of the different intersections of diversity being represented, it may be a useful tool for educators to spot any particularly weak intersectional deviations or gaps, or negative representations. This could therefore help educators to focus-in on specific aspects of their teaching at a more micro-level of detail.

GRADES10© Limitations and Recommendations

Using the GRADES10© can be a time-consuming process as it requires analysing resources in depth, on top of users familiarising themselves with the user guide. The process of gaining diversity marks is often done once and should only need be done again if significant improvements or changes are made to a teaching resource/reading list.

The final version of GRADES10© focuses on measuring 10 key attributes, however, an important area where users may be conflicted is related to the more detailed characteristics of intersectionality. Definitions of intersectionality acknowledge that independently perceived identities often overlap [39]. It was outside of the remit of this study and this tool to look at how different forms of oppression are interconnected, and therefore the GRADES10© measures key attributes in isolation.

When reviewing resources, it is possible that there is risk of discrepancy and/or bias, and therefore, as recommended above, a team approach is advocated. This could be the organisations' EDI committee, appointed to apply the GRADES10© to teaching resources, as a group. A particular example of discrepancy that arose during this study when testing the tool, was with an image of a white man in a wheelchair. The wheelchair (the image of disability) gained a score, however, the white male did not, and so the concept of privilege still existed to an extent. Conversely, if the educator had chosen a picture of a black woman in a wheelchair, the image would score highly for race, gender and disability, but only if represented positively by showing the woman as a role model of some kind. Although the user guide gives instructions to limit the risk of subjective interpretation and unconscious bias, there will always be risk, hence a team approach to using the tool is strongly advocated. Biases were difficult to fully eliminate. More studies are required to further test the tool on different types of resources, gather more data and gain more insight into the tool's capabilities.

Further Recommendations

In future, the GRADES10© may benefit from AI integrated automated text and image analysis tools to help speed up, identify and categorise diversity data.

In terms of application, the GRADES10© could offer utility to other areas of undergraduate medical education and CME, and also to the broader healthcare professions. For example, if applied across multiple institutions, it would be interesting to see if the GRADES10© were to yield comparable results in terms of, for example, location and prestige of the academic institution, SES and academic results. Another possibility would be to GRADE admissions policies or look at admissions data across, for example, religious (Catholic, Islamic) Vs. non-religious organisations and how they favour the EDI categories.

At our institution, there are defined values, which are reflected in the curriculum, however, it is possible for two institutions with different values to have curricula that are decidedly proactive towards EDI, therefore it would be interesting to see if the GRADES10© can reflect or measure this.

Conclusion

The validated GRADES10© tool offers an interpretable, visual and quantitative EDI scoring system. With an overall ICC of 83% the GRADES10© tool is deemed to have good reliability. This study has shown that diversity can be reliably measured in medical education teaching resources. Diversity representation in medical school curricula should not just be a tick box exercise but rather a consistent and applied improvement exercise with continuous revision, to ensure better preparation of future and qualified doctors for the treatment, care and respect of a diverse patient population and workforce. Introduction and application of The

GRADES10© tool may therefore support medical schools and organisations offering CME, to better challenge exclusion and promote active inclusion. Indeed, any organisation with responsibility for demonstrating EDI accountability, may benefit from a GRADES10© analysis of their internal resources [40].

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