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Puberty through Their Lens: Insights from Youth around the World

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ABSTRACT: Puberty, as the biological process of sexual maturation during adolescence, is a human generality that occurs across cultures. Primarily based on quantitative data from Western industrialized countries, puberty has been characterized as troublesome and stressful for adolescents. It has been linked to negative personal perceptions and negative consequences for psychosocial adaptation. These effects seem to be amplified by risks within proximal social interactions, which, in turn, are embedded in the broader cultural context. Using mixed-methods approach, the current exploratory study investigated the personal perceptions of puberty among adolescents from various cultural backgrounds. Data from 16 countries from Africa, America, Asia, and Europe were analyzed (13 yr., N = 715; 50.3% female). Differences in positive *vs.* negative personal perceptions of puberty emerged across cultures and genders, and qualitative statements of girls and boys reveal important insights into the proximal developmental mechanisms to well-being and health during the pubertal transition around the world. These findings not only enrich basic research but also inform gender-sensitive and culturally sensitive prevention and intervention tools for adolescents.

Keywords: Adolescence; Puberty; Cross-cultural

1. Introduction

Puberty, a universal and key maturing period involving physical, socio-emotional, and cognitive changes, has gained a reputation as a tumultuous progression of strife and stress [1]. This reputation has attracted multi-disciplinary research over the decades, with most of the evidence coming from the Global North, mainly from middle to high-SES backgrounds in Northern America and parts of Europe, backing this negative notion of puberty. However, is this reflection warranted, and does this apply to cultures across the globe? Or, in other words, is the way puberty is reflected in young males and females moderated by their cultural context? The current study is filling this research gap by investigating adolescents' own experiences of puberty across 16 countries covering four continents to explore the (dis)similarities in youths' pubertal experiences around the globe. Thus, this study is a direct response to the recent pleas for expanding puberty research to population groups from various cultural backgrounds, including male adolescents beside the relatively well-studied females [2,3], using an unbiased, decolonized, culturally comparative view including the so far underrepresented countries of the Global South [4]. Moreover, this study responds to the current call for research incorporating an intersectional understanding framework [5,6], thereby using qualitative methods to map the individual responses to physical changes in puberty where they have not been investigated before.

Prior research from Northern America and parts of Europe found that puberty (primarily based on assessments via Puberty Development Scale (PDS) and Tanner Scales, but also age at menarche, spermarche, and growth spurt) is associated with negative personal perceptions and negative consequences in various aspects of psychosocial adaptation (*e.g.*, [7–16]). Modern approaches to puberty research try to identify the more complex moderation processes behind these associations, asking questions such as "Under which conditions or for whom does a relationship between puberty and outcomes exist, and in what direction?" Natsuaki and colleagues state that the association between puberty and adaptation is amplified by conditions within proximal social interactions (*e.g.*, reactions to physical growth and pubertal

development) within family, peer context, and in school [17,18]. These, in turn, are embedded in and influenced by the broader cultural context, its values, and norms (*e.g.*, for the preferred body shape of males and females). Furthermore, societies differ, among other factors, in their structuring of the transition from childhood to adolescence, the existence and characteristics of rituals, or preparation for adult life in the sense of knowledge transfer to young people on pubertal development, sexuality, or appropriate role behavior. All of these cultural and societal factors shape how family, peers, and school deal with puberty and how adolescents perceive and react to physical changes in this life period [3,19–21]. They influence the messages adolescents receive about puberty, shaping their personal experiences [22], which, in turn, impact psychosocial adaptation [23]. At least from the currently existing research on this topic, developmental mechanisms and psychosocial consequences of puberty and the gender-specific effects of aspects of the cultural context (values and beliefs, gender stereotypes and gender roles, culturally anchored beauty ideals, *etc.*) can be assumed to vary between males and females [3,16,24]. Supporting the view that different aspects of the cultural contexts possibly impact male and female adolescents' pubertal experiences, empirical research from countries of the Global North demonstrates that preparation and education received before puberty are important factors in promoting positive reactions to pubertal events [22]. For instance, girls who felt uninformed or unprepared for menstruation were more likely to report having negative experiences and attitudes about menarche and more menstrual distress, [8,25] and tended to have more physical and emotional difficulties in making sense of their pubertal experiences [23,26]. Research has shown that unprepared girls reported more negative experiences than those who felt prepared to handle issues related to the pubertal transition [25,27,28].

Compared to girls, there are fewer studies for boys examining cultural factors and their impact on pubertal experiences. However, there seems to be less sharing of puberty information with boys among peers and adults, with most information coming from personal reading materials [29]. Knowledge transfer, in turn, appears to play a significant role as a moderating factor between puberty and psychosocial adaptation [23,30–32]. Although many boys had some prior knowledge of ejaculation, some still felt unprepared. Nevertheless, most of their reactions were positive, with only a few reporting negative experiences [33,34].

It is well-known that adolescent girls from countries of the Global South or low-income countries receive insufficient information and support before and during puberty [35,36], and additional challenges further complicate their experiences. For instance, young females have to navigate unequal gender norms that prioritize young men over females [37], and cope with limited access to public spaces [38]. Boys also suffer from a lack of knowledge and silence regarding their body changes during puberty, leading to feelings of worry and anxiety about these changes, pressure related to their new status expectations [39], as well as fear and shame [40–42]. For boys, however, there are additional themes of virility and strength related to puberty [41,43]. Please note that the studies reviewed here were qualitative in nature; hence, they use age at menarche and spermarche as indicators for pubertal development, marking explicitly the pubertal transition, with high relevance for the individual. A review of puberty research using PDS and Tanner Scales, primarily within quantitative research, has been excellently done elsewhere (*e.g.*, [44,45]).

In sum, differences in various aspects of cultural contexts—preparation before puberty, knowledge transfer, societal expectations, values, and norms—influence adolescents' personal pubertal experiences and psychosocial adaptation. However, the majority of the concepts, theories, research findings, and professional practices in the puberty literature originate from the Global North, mainly from middle to high-SES backgrounds in Northern America or parts of Europe, using quantitative and epic research methods. They therefore bypass the majority of the world's population, as well as the richness of qualitative data, and the application of emic research methods to explore cultural differences through an insider's eye [8,44]. The current study aims to fill this research gap. Given that the individual experiences of puberty are influenced by contextual factors such as ethnicity, political divisions, income levels, cultural practices (*e.g.*, puberty rites), individualistic/collectivistic outlooks, cohort effects, *etc.* [17,20,21,45–48], studies are urgently needed that employ a fair research representation around the world for a more balanced view of the universal phenomenon of puberty [2]. This includes the equal inclusion of the Global South and Global North in research, reaching out to countries that have so far been underrepresented in puberty research.

Based on this background, the present study aimed to investigate the personal perceptions of puberty among male and female adolescents from 16 Global North and South countries via a systematic emic cultural comparative, multi-method (explicitly including qualitative data), and exploratory approach.

More specifically, this study wants to

1. Examine how girls and boys around the world perceive puberty and physical changes associated with it (quantitative data) and
2. Explore the themes surrounding puberty in the eyes of adolescents by focusing on the valence (positive *vs.* negative) attached to puberty and associated physical changes (qualitative data).

This is an exploratory study, as it includes several regions of the world without previous studies on adolescents' perceptions of puberty. The explorative approach is appropriate when not much is known about a particular phenomenon [49]. Thus, we aimed to be open-minded and without predictions in collecting insights primarily via qualitative data to draw a picture of experiencing puberty and its environment, to inform further basic and applied research. Therefore, the present study investigated a sample in early adolescence. At age 13, most adolescents of both sexes in all cultures are either at the beginning or in the middle of pubertal maturation, and some (especially female) adolescents with early timing may even be at the end of puberty. Consequently, this is a perfect time to study puberty because the stage of pubertal development is most variable [50]. International studies document that early adolescence is a particularly challenging period of adolescent youth development related to increases in the prevalence of problem behavior—especially in girls, mental health drops dramatically between the ages of 11 and 13 (*e.g.*, [51]). In the current study, we are interested in the developmental mechanisms related to puberty that contribute to psychosocial adaptation and health to inform practice attempts. A time window with high variability in outcomes is therefore most suitable, not only for studying developmental mechanisms but also for implementing prevention and intervention measures.

2. Method

This research is based on the global study, Puberty x Culture, which involved 16 countries around the world, coordinated by the Department of Youth Research at Friedrich Schiller University Jena, Germany (PI: Karina Weichold; [3,52]). Data were collected in collaboration with local partners in the respective countries.

2.1. Material and Procedure

The project PI provided all collaborators with the standardized study materials in English, including (1) questionnaires, (2) a procedural checklist, (3) scale documentation, (4) datasheets, and (5) a detailed project manual and guidelines. The detailed project manual and procedural checklists were designed to ensure control of method bias. Study guidelines concerned regulations on study populations (*e.g.*, required school characteristics, students' gender and age), translation processes, and data processing (*e.g.*, coding).

There were three questionnaires in all, one for the collaborators (general information about the country, *e.g.*, population, ethnic groups, religion, cultural values, predominant beauty ideals), one for the school personnel (general information about the school, *e.g.*, number of students, single-gender or co-educated, private or public, special programs, as well as school's atmosphere, *e.g.*, problems at this school, teacher's commitment, sex education/topic puberty), and another for the adolescent (including questions on socio-demographic variables [*e.g.*, age, gender] and their personal experiences of puberty). Guidelines for the translation processes were included in the study manual to safeguard measurement equivalence. The sequential translation process followed the following steps: we first adopted the already translated standardized measures if they were available in the respective countries' languages. For instruments lacking official translation, multiple forward translations were executed: each collaborator formed a panel of expert translators, including native speakers, who collectively determined the wording of the items. Each item's meaning, pertinence, and practicality in the respective countries' context were discussed collectively. As specified in the study guidelines, disputed items were also forwarded to the project team in Germany to define and elaborate underlying (cultural) constructs and word meanings further.

The collaborators completed a questionnaire designed to assess country-specific information. The headteachers at the schools filled out a second questionnaire evaluating their school's characteristics. Each partner adhered to their respective countries' and universities' ethical guidelines and requirements. The partners secured informed consent from teachers, adolescents, and legal guardians. The adolescents completed the third questionnaire in their respective languages. The survey was conducted in the participants' classrooms for approximately one hour and was overseen by our local project partner and a schoolteacher familiar with the questionnaire.

The local project collaborators processed the students' data using standardized IBM SPSS Statistics or MS Excel datasheets and translated open-ended responses into English. Both students' data and collaborators' information were then sent to the project team in Germany for quantitative and qualitative analyses. Incoming data were double-checked

for correct coding as well as consistency and verified by requesting a scanned copy of the original pen-and-paper questionnaires, where appropriate.

2.2. Sample

2.2.1. Countries

The adolescents were from four continents and 16 countries (representing the Global North and South), namely (in alphabetical order) Brazil, Bulgaria, China, Ecuador, Georgia, Germany, Ghana, India, Iran, Japan, Kenya, Lithuania, Poland, Portugal, Turkey, and the U.S. These countries were selected with the aim of having a sample of countries as diverse as possible, with a range of cultural and societal contexts and value systems [53,54], different religious backgrounds, and varied traditions of puberty rites. The participating countries rank from 5th to 142nd (M = 65.88; SD = 43.21) on the 2018 Human Development Index (HDI) [55], with lower-numbered rankings indicating higher human development (Dimensions: long and healthy life, knowledge, decent standard of living).

The local collaborators rated cultural aspects (cultural diversity, ethnic separation, autocratic culture, ambiguity tolerance) of their respective countries on a 7-point Likert scale from 1 to 7 (with higher values indicating a stronger occurrence and/or application). Cultural diversity (M = 4.44; SD = 2.31) was rated low or very low for seven countries (43.75%); Poland, Japan, and Ghana, for example, were slightly above average; and eight countries (50%) were rated high or very high for cultural diversity (*e.g.*, India, and the U.S.). Ethnic separation (M = 4.06; SD = 1.39) was mostly rated average or moderately below/slightly above average, with the exception of China with low ethnic separation, Japan and Bulgaria with high, and Brazil with very high ethnic separation. In eight countries (50%), the autocratic culture (M = 4.00; SD = 1.46) was rated average or moderately below/slightly above average; in three countries the autocratic culture rating was weak (18.75%; Germany, Ecuador, and the U.S.); while five countries were rated as having a strong autocratic culture (31.25%; Brazil, Ghana, Japan, Poland, and Turkey). Tolerance of ambiguity (M = 3.94; SD = 2.08) was rated very low in Portugal and very high in Brazil; in 50% of the respective countries the tolerance of ambiguity was rated as low or moderately below average, in 37.5% as high.

In most countries (68.75%), boys and girls have almost equal access to the same level of education (M = 5.63; SD = 1.71), with the exception of Brazil, which is around average, and Ghana, India, Iran, and Portugal, which are below average. For the majority of countries (81.25%), only one parent is usually involved in child rearing (highest rating for Ecuador and lower ratings for Germany and the U.S.), with the exception of Bulgaria, China, and Lithuania, which are above average. The possibility of having romantic and sexual experiences during puberty for males (M = 4.56; SD = 2.03) and females (M = 2.94; SD = 1.53) was also rated by the local collaborator on a 7-point Likert scale from 1 to 7 (higher values representing a greater opportunity for male or female adolescents). Opportunities are greater, for example, for German and Bulgarian males and females than for Chinese and Iranian males and females, whereas boys from Ghana and Poland have more opportunities than girls from Ghana and Poland. The country's predominant ideal of beauty for males (M = 3.99; SD = 0.92) and females (M = 3.23; SD = 1.15) was assessed using a 9-point Figure Rating Scale [56]. As the predominant beauty ideal, a body shape of appropriate weight was rated as an ideal body type for most of the countries (75% males, 68.75% females), whereas an underweight body shape was preferred for males in Japan and females in Ecuador, Japan, Lithuania, and Poland. A slightly overweight body shape was rated ideal for males from Poland and Portugal, and a moderately overweight body shape was the predominant beauty ideal for males and females from Ghana. Furthermore, the collaborators reported that nine of the 16 countries have some kind of ritual for pubertal transition (see Table 1). The participation in puberty rites was also rated by the students, with the highest share in Brazil, Kenya, and Iran (see Table 2).

Table 1. Sample Characteristics—Countries.

	Global North/ Global South	**HDI 2018 (1–189) Ranking**	**Cultural Diversity * (1–7)**	**Ethnic Separation * (1–7)**	**Autocratic Culture * (1–7)**	**Ambiguity Tolerance * (1–7)**	**Same Education for Both Sexes * (1–7)**	**Child Rearing by Both Parents * (1–7)**	**Pubertal Romantic and Sexual Experiences for Adolescent Males * (1–7)**	**… and Females * (1–7)**	**Beauty Ideal for Males * (1–9)**	**… and Females * (1–9)**	**Puberty Rituals * (Yes-No)**
Country													
Brazil	GS	79	6	7	4	7	5	2	7	2	4	3	yes
Bulgaria	GS	51	2	6	3	6	7	5	7	6	4	3	no
China	GS	86	6	2	3	6	6	5	1	1	3	4	no
Ecuador	GS	86	6	3	2	6	7	1	2	2	4	2	yes
Georgia	GS	70	3	4	4	3	7	3	5	2	4	3	no
Germany	GN	5	6	3	2	2	7	3	7	6	3	4	yes
Ghana	GS	140	5	3	6	6	3	2	6	1	6	6	yes
India	GS	130	7	4	4	6	2	2	6	2	4.5	3.5	yes
Iran	GS	60	7	4	5	2	4	2	2	2	4	3	yes
Japan	GN	19	2	6	6	6	6	3	3	3	2	1	yes
Kenya	GS	142	7	4	4	2	7	2	4	3	4	4	yes
Lithuania	GN	35	2	5	4	3	7	5	4	4	3.5	2.5	no
Poland	GN	33	1	5	6	2	7	2	6	1	5	2	no
Portugal	GN	41	2	3	3	1	3	2	5	3	5	4	no
Turkey	GS	64	2	3	6	3	6	2	4	2	4	4	no
USA	GN	13	7	4	2	2	6	3	6	3	3	4	yes
Min		5	1	2	2	1	2	1	1	1	2	1	
Max		142	7	7	6	7	7	5	7	6	6	6	
Mean		65.88	4.44	4.06	4.00	3.94	5.63	2.75	4.56	2.94	3.99	3.23	
SD		43.21	2.31	1.39	1.46	2.08	1.71	1.24	2.03	1.53	0.92	1.15	

Note. * Variables with an asterisk were answered by local collaborators. Global North (GN) and Global South (GS) [57]: North–South divide with regard to socio-economics and politics. In the Human Development Index (HDI), lower rankings indicate higher human development. For all items rated on a 7-point Likert scale, higher values indicate a stronger occurrence and/or application. "Pubertal romantic and sexual experiences" refers to the possibility of having romantic and sexual experiences during puberty; higher values represent a greater opportunity for male or female adolescents. Beauty ideals were assessed using a 9-point Figure Rating Scale [56], which shows body shapes of underweight (images 1 and 2), appropriate weight (images 3 and 4), slight overweight (image 5), moderate overweight (images 6 and 7), and strong overweight (images 8 and 9). Collaborators also reported whether there is any kind of ritual for pubertal transition in their country.

2.2.2. Schools

To ensure the comparability of data across countries, we recruited one school in an urban setting per country. Most of the schools were public (81%; n = 16), and school size ranged from 174 to 2,556 students (M = 1027.00; SD = 730.15). On average, coeducational schools (n = 15) accounted for 48.8% female students (SD = 4.95); in Iran, data for male and female adolescents needed to be collected separately (thus, N = 17 schools). The "average socio-economic status of students in the schools compared to the country", rated by the collaborator using a scale from 1 to 9 (with higher values indicating greater wealth, better education, and greater occupational prestige), was mostly rated as average or moderately above average (M = 5.67; SD = 1.84), with the exception of Brazil and Kenya, which were below average. Eight schools (53.3%) provided sex education as part of the curriculum, whereas nine schools (64.3%) reported that puberty is an actively addressed topic in the school curriculum. An overview of the school characteristics is shown in Table 2, section "schools" (see Table 2).

2.2.3. Students

The age of participants (total N across 16 countries = 715) was on average 13.1 years (SD = 0.47, ranging from 12–15 years). The narrow age range (in addition to the reasons mentioned in the introduction) was chosen to limit age-related variance in problem behavior and value configuration [58,59]. The proportion of male and female adolescents was nearly even within the whole sample (50.3% female), with a slightly broader range within each country studied (44.7–57.8% female) (see Table 2).

2.3. Measures

Students

The students' self-report questionnaire had both closed-ended questions yielding quantitative data and open-ended questions yielding qualitative data.

2.4. Quantitative Measures

2.4.1. The Assessment of the Subjective Status of Pubertal Development

This was a set of five items based on the Puberty Development Scale (PDS) [60] answered on a 4-point Likert scale (0 = has not yet started; 3 = seems complete). Girls rated their growth on breast development, menarche, growth spurt, and pubic hair, while boys rated their development on growth spurt, pubic hair, and voice deepening. Mean scores of pubertal development were computed, with higher scores indicating more advanced pubertal development. As part of the subjective pubertal development assessments, respondents specified the age at which menarche started (for girls), and the voice started deepening (for boys). The PDS is most suitable to assess the status of pubertal development in early adolescence, in a cross-national sample, with the aim of focusing on self-perceptions within a given social and cultural context. The scale is a widely used measure, practicable and accepted, reliable, and showing high validity. Finally, the PDS is an accurate measure, *i.e.*, positively correlated with many other measures of puberty, including basal hormonal measures, Tanner Stages, age at menarche (AAM), and age at voice change (AVC) (see [3,50,61,62]). In line with this, also in the current study, there are significant positive correlations between the PDS score and AAM (r = 0.330; $p < 0.001$), and between the PDS score and AVC (r = 0.531; $p < 0.001$). Furthermore, the PDS score is positively correlated with height (r = 0.297; $p < 0.001$) and weight (r = 0.311; $p < 0.001$; Ghana was excluded due to missing values), indicating high validity of the PDS.

2.4.2. Puberty in General

The four broad and evaluative items in the format of a semantic differential assessed adolescents' personal meanings associated with puberty. These items were designed specifically for this project and function as a "door opener" to the following in-depth qualitative statements on puberty. Using a 7-point Likert scale (−3 = negative; 3 = positive), adolescents rated their perspectives and attitudes toward puberty on a continuum of two adjectives. The sample items included: *'Puberty is… negative/positive'*, *'Puberty is… unnatural/natural'*, *'Puberty makes me weak/strong'*, and *'Puberty makes me ugly/beautiful'*. Participants responded to these items, and mean scores were computed for analysis. Higher scores indicated that adolescents had more positive and favorable views of puberty.

Table 2. Sample Characteristics—Schools and Students.

	SCHOOLS					STUDENTS			
	Students in Total *	**School Body * (Private *vs.* Public)**	**Mean Socio-Economic Status * (1–9)**	**Sex Education in School * (Yes-No)**	**Puberty Addressed in School * (Yes-No)**	**Participants**	**Financial Situation of Parents (1–5)**	**Predominant Religious Affiliation**	**Puberty Rituals**
Country	**N (% Female)**					**N (% Female)**	**Mean (SD)**	**%**	**%**
Brazil	354 (51)	public	1	yes	-	39 (49)	3.82 (0.60)	69% Christian	41
Bulgaria	518 (52)	public	5	no	yes	40 (50)	4.08 (0.47)	100% Christian	0
China	1660 (40)	public	7	yes	yes	40 (50)	3.85 (0.62)	25% Buddhist	10
Ecuador	2000 (48)	private	7	no	yes	45 (58)	3.98 (0.66)	98% Christian	9
Georgia	2556 (51)	public	5	no	no	40 (50)	3.88 (0.69)	95% Christian	20
Germany	800 (51)	public	6	yes	yes	44 (52)	3.91 (0.74)	84% Christian	7
Ghana	1600 (50)	public	6	yes	yes	46 (57)	4.26 (0.82)	83% Christian	2
India	947 (39)	private	7	yes	no	40 (50)	4.23 (0.77)	68% Sikh	0
Iran	1170 (49) [a]	public	5/5	no/no	yes	41 (49)	3.51 (0.64)	100% Muslim	37
Japan	338 (49)	public	9	yes	no	75 (47)	3.68 (1.00)	52% Folk Shinto	7
Kenya	2000 (50)	public	2	no	yes	40 (50)	4.15 (0.77)	100% Christian	38
Lithuania	1100 (48)	public	6	no	no	41 (51)	4.13 (0.61)	90% Christian	5
Poland	350 (60)	public	6	yes	yes	45 (49)	3.66 (0.94)	69% Christian	9
Portugal	174 (47)	public	5	yes	no	38 (45)	3.81 (0.62)	76% Christian	8
Turkey	350 (51)	private	7	no	yes	44 (46)	4.16 (0.53)	100% Muslim [b]	5
USA	1035 (46)	public	-	-	-	57 (53)	3187 (0.75)	72% Christian	25

Note. * Variables with an asterisk were answered by local collaborators. [a] In Iran, data for male and female participants needed to be collected separately. [b] In Turkey, it was not possible to ask for students' religious affiliation; the value was given to us by the school. SCHOOLS: Local collaborators and principals rated the average socio-economic status of students compared to the country on a scale from (1) to (9), where higher values indicate more money, better education and higher occupational prestige. STUDENTS: Students rated the financial situation of their parents as (1) very bad, (2) bad, (3) neither bad nor good, (4) good, or (5) very good. Students were also asked whether they participated in any ritual of pubertal transition.

2.5. Qualitative Measures

The qualitative measures consisted of follow-up, open-ended questions attached to three of the quantitative measures of the general puberty questions above. These were: *'Puberty is... unnatural /natural, why?', 'Puberty is... negative /positive, why?'* and *'Puberty makes me weak/strong, why?'*. No qualitative data were gathered for the fourth quantitative measure (puberty makes me ugly *vs.* beautiful).

3. Data Analysis

3.1. Quantitative Analysis

The quantitative analysis involved descriptive statistics (frequencies, means, and standard deviations), using IBM SPSS Statistics version 27 for Windows.

3.2. Qualitative Analysis

The qualitative data were analyzed using content analysis, "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" [63] (p. 1276). The analytical procedures for the qualitative data were designed to ensure rigor in the analysis and trustworthiness of the results, following the guidelines set forth by Hsieh and Shannon (2005) [63]. The themes presented in the results emerged from the content of the data; therefore, no pre-established categories were created. The coding team consisted of research assistants with international backgrounds, ensuring that the international data were analyzed carefully and thoroughly, with each country's data examined individually. First, the initial coders (two researchers) worked independently, reading through the transcribed data multiple times to immerse themselves in and gain an appreciable sense of the data. They first identified keywords within the responses and aggregated them into codes and themes for each item. In addition to the themes, the coders generated nominal data to test for inter-coder reliability [64–66] by coding the responses as (1 = negative, 2 = neutral, 3 = positive). In the second step of the analysis, two additional researchers jointly discussed the generated codes and themes and agreed on the final sets of themes. These final sets of themes were again checked by an expert in puberty research who was familiar with the study and the data, to provide feedback and confirm the final themes. In this way, the quality and precision of the analysis and results were upheld. Following the analysis of themes surrounding pubertal development in the entire sample, for a coherent and concise picture of the results, further qualitative data analysis focused on the three countries with the most positive and negative puberty perceptions. A conceptual grouping approach to organize subjects into categories based on shared properties or to arrange scores in categories [49] was applied to group the top/bottom three countries with positive/negative personal perceptions of puberty. Therefore, subgroups had to appear at least twice in the top/bottom means on the four items on personal perceptions of puberty depicted in Table 3.

Table 3. Means and Standard deviation of quantitative items.

	PDS (1–4)		Age at Voice Change *	Age at Menarche *	Puberty Is … Negative *vs.* Positive (−3–3)		Puberty Is … Unnatural *vs.* Natural (−3–3)		Puberty Makes Me Weak *vs.* Strong (−3–3)		Puberty Makes Me Ugly *vs.* Beautiful (−3–3)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Country (N = 715)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Brazil (39)	2.57 (0.79)	2.87 (0.63)	11.82 (0.75)	11.40 (0.91)	2.10 (1.55)	1.26 (1.45)	2.50 (0.95)	2.05 (1.32)	1.40 (1.98)	1.30 (1.26)	1.35 (1.35)	1.42 (1.02)
Bulgaria (40)	2.92 (0.64)	2.91 (0.41)	12.07 (0.48)	12.35 (0.49)	1.55 (1.32)	1.55 (1.10)	1.90 (1.07)	2.20 (0.951)	1.95 (0.95)	1.45 (1.05)	2.00 (1.17)	1.05 (1.43)
China (40)	2.30 (0.90)	2.76 (0.53)	12.00 (0.94)	12.22 (0.75)	1.00 (1.17)	1.45 (1.32)	1.35 (1.18)	1.95 (1.31)	1.40 (1.31)	1.70 (1.34)	0.90 (1.25)	1.10 (1.12)
Ecuador (45)	2.89 (0.71)	2.86 (0.63)	12.36 (0.84)	12.14 (0.73)	0.94 (1.21)	0.48 (1.61)	2.17 (1.59)	2.44 (1.23)	1.63 (1.31)	0.68 (1.35)	0.94 (1.51)	0.50 (1.45)
Georgia (40)	2.55 (0.69)	2.66 (0.73)	12.40 (0.52)	11.64 (1.01)	1.70 (1.46)	1.00 (1.69)	2.45 (1.05)	2.20 (1.24)	1.90 (1.29)	0.30 (1.75)	0.75 (1.33)	0.70 (1.78)
Germany (44)	2.53 (0.80)	2.94 (0.63)	12.30 (1.34)	11.44 (0.97)	1.19 (1.33)	−0.13 (0.63)	2.29 (0.90)	1.95 (1.46)	1.67 (1.46)	−0.24 (1.14)	0.52 (1.33)	−0.26 (1.29)
Ghana (47)	2.91 (0.57)	2.98 (0.56)	12.17 (1.19)	11.35 (1.18)	1.90 (1.17)	2.38 (1.36)	2.37 (0.96)	2.92 (0.28)	1.45 (1.64)	1.17 (1.92)	2.25 (1.07)	2.04 (1.27)
India (40)	2.93 (0.58)	3.05 (0.60)	11.83 (0.71)	12.11 (0.47)	1.80 (1.36)	0.40 (2.09)	2.55 (1.19)	2.15 (1.53)	1.90 (1.25)	0.35 (2.11)	1.00 (1.45)	0.75 (1.77)
Iran (41)	2.90 (0.62)	2.98 (0.48)	12.28 (0.78)	12.06 (1.16)	1.10 (1.30)	0.20 (1.80)	1.50 (1.54)	1.42 (1.26)	1.90 (1.33)	1.11 (1.33)	1.19 (1.47)	0.45 (1.70)
Japan (75)	2.43 (0.73)	2.56 (0.65)	12.30 (0.64)	11.80 (0.65)	0.67 (1.24)	0.47 (1.30)	1.62 (1.55)	1.14 (1.56)	1.13 (1.28)	1.08 (1.48)	−0.35 (1.16)	−0.17 (0.94)
Kenya (40)	2.07 (0.73)	2.19 (0.65)	10.75 (1.67)	11.90 (0.55)	−0.05 (2.33)	1.00 (2.47)	1.50 (2.24)	1.72 (2.16)	0.35 (2.03)	1.10 (2.47)	0.40 (1.79)	1.63 (1.98)
Lithuania (41)	2.73 (0.65)	2.73 (0.54)	12.50 (0.52)	12.15 (1.21)	1.00 (1.56)	0.90 (1.21)	1.85 (1.35)	2.60 (0.82)	1.10 (1.33)	0.55 (1.05)	0.85 (1.42)	−0.05 (1.57)
Poland (45)	2.35 (0.87)	2.78 (0.53)	12.38 (0.52)	11.69 (0.79)	0.87 (1.42)	0.27 (0.94)	2.27 (1.03)	2.00 (1.16)	1.18 (1.40)	−0.05 (1.23)	0.91 (1.24)	0.45 (1.14)
Portugal (38)	2.76 (0.62)	2.96 (0.52)	11.92 (1.08)	11.50 (1.16)	0.95 (1.72)	1.29 (1.26)	2.10 (1.21)	2.82 (0.53)	1.38 (1.28)	0.75 (1.18)	1.10 (1.45)	0.47 (1.28)
Turkey (44)	2.74 (0.95)	2.86 (0.56)	11.92 (1.12)	11.88 (0.89)	0.35 (1.87)	0.65 (1.39)	2.26 (1.39)	2.95 (0.22)	1.55 (1.87)	1.75 (1.45)	0.58 (1.72)	0.05 (1.40)
USA (56)	2.60 (0.74)	2.80 (0.54)	12.07 (0.59)	11.50 (1.10)	1.42 (1.30)	0.59 (1.09)	2.44 (1.30)	2.07 (1.46)	1.35 (1.47)	0.04 (1.60)	0.35 (0.78)	0.33 (1.65)
Mean (SD)	2.63 (0.76)	2.80 (0.60)	10.14 (4.38)	10.40 (3.82)	1.18 (1.57)	0.88 (1.59)	2.11 (1.33)	2.24 (1.27)	1.46 (1.52)	0.77 (1.63)	0.91 (1.43)	0.73 (1.54)
N	352	359	220	280	313	321	308	315	308	311	346	360

Note. * Only those who have already experienced menarche or voice change.

4. Results

4.1. Quantitative Research Results

4.1.1. Subjective Status of Pubertal Development

Indian boys had the highest mean PDS score, followed by Bulgarian boys. Kenyan males had the lowest mean PDS scores, followed by Chinese and Polish males (Table 3). Indian girls had the highest PDS score in general. This was followed by Portuguese females, while the least developed among the females were Kenyan girls. Despite their low PDS scores, Kenyan boys indicated their voices started to change at the earliest average age, and Brazilian boys' voice change ranked second earliest. Lithuanian boys had, on average, the oldest average age of voice change, followed by Georgian boys. Ghanaian female adolescents had the earliest average age at menarche, while Bulgarian female adolescents had the oldest average age at menarche. The PDS score was not correlated with adolescents' personal meanings associated with puberty, which indicates that more positive/negative perceptions of puberty were independent from their own status of physical development.

4.1.2. Puberty Is Negative *vs.* Positive

For the males, Brazil, Ghana, and India were the countries with the highest means and therefore more positive valence attached to puberty. The countries with the lowest means for males were Kenya, Turkey, Japan, and Poland. For females, Ghana, Bulgaria, and China were the countries with the highest (positive) means, while the countries with the most negative general perception of puberty were Germany, Iran, and Poland.

4.1.3. Puberty Is Natural *vs.* Unnatural

For the males, Brazil, India, and Georgia were the countries with the highest means (puberty as natural event). The countries with the lowest means (puberty as unnatural event) were China, Iran, and Kenya. For females, Turkey, Ghana, and Portugal had the highest means, while Japan, Iran, and Kenya had the lowest.

4.1.4. Puberty Makes Me Weak *vs.* Strong

Among the males, Bulgaria, India, Iran, and Georgia had the highest means (strength associated with puberty). Kenya, Japan, Lithuania, and Poland had the lowest means (weakness associated with puberty). For females, the highest means were found in Turkey, China, and Bulgaria. Germany, Poland, and the U.S. had the lowest means, thus associating puberty with weakness.

4.1.5. Puberty Makes Me Ugly *vs.* Beautiful

For the males, the highest means (puberty makes me more beautiful) were from Ghana, Bulgaria, and Brazil, and the lowest (puberty makes me ugly) were from Kenya, the U.S., Japan, Turkey, and Poland. For females, the highest means were in Ghana, Kenya, and Brazil, and the lowest were found in females from Germany, Japan, Lithuania, and Turkey.

In sum, quantitative data analyses (aim 1) revealed a great variation in the personal perceptions of puberty among girls and boys from different cultural contexts. For males from India, Brazil, and Ghana, puberty is especially positively associated (*i.e.*, top mean at least twice across items) in contrast to those from Kenya, Turkey, and Poland (*i.e.*, bottom mean at least twice across items). For females from Ghana, Bulgaria, and China, puberty is connotated very positively (*i.e.*, top mean at least twice across items), while females from Germany, Iran, and Poland have particularly negative perceptions of puberty (*i.e.*, bottom mean at least twice across items). The most striking divergences in positive *vs.* negative perceptions of puberty across all four items were observed for females from Ghana *vs.* Germany and males from India *vs.* Kenya (*i.e.*, top/bottom mean at least three times across items).

4.2. Qualitative Research Results

The qualitative analysis of the three open-ended questions revealed common themes among adolescents from the 16 countries: 'growth', 'development', 'psychological changes', and 'normal universality in the life cycle'. Inter-coder reliability analysis revealed alpha levels ranging from 0.70 to 0.85, indicating acceptable to relatively high inter-coder reliability, further signifying high agreement among the coders regarding the generated themes (Hayes & Krippendorff, 2007). The results are presented below, first with the common themes that adolescents associate with puberty across the entire global sample, followed by the findings highlighting these key themes in the countries with the top three most

positive (India, Brazil, and Ghana for boys and Ghana, Bulgaria, and China for girls) and negative scores (Kenya, Turkey, and Poland for boys and Germany, Iran, and Poland for girls), based on the means scores from the three items in Table 3, with quotes from respondents included as examples.

4.2.1. Key Themes on Puberty in the Entire Sample

Growth and development. First, some responses centered on the theme of growth and change with subthemes including becoming adults, physical and mental growth, and sexual maturity and development, *e.g.*, "*It makes people see that the person is growing into an adult" (m, Ghana); "If not puberty, there won't be a reproduction" (m, Georgia)*.

Psychological changes. A second major theme centered on psychological growth or changes. Here, the adolescents emphasized the mental maturity that comes with adolescence and their overall experiences. Subthemes included the development in their character, increase in responsibilities and independence, increase in intelligence, general brain capacity and thinking, and increased confidence, *e.g.*, *"Because during puberty we start to see the world in a different way, we become more mature and stronger." (f, Brazil); "Adolescence can make the person become independent and more powerful" (f, China).*

Normal universality in the life cycle. Finally, another oft-mentioned theme was derived from responses focused on the universality of puberty and puberty being necessary for adulthood. This sentiment also includes the assurance that everyone experiences puberty, hence it is a shared experience; therefore, there is no escaping it. Despite the difficulties one may encounter with puberty, life will be problematic without the experience of it. *e.g.*, *"Because all of us go through this and because it is important for our lives." (f, Brazil); "It is a natural phenomenon" (f, India); "Because it is a must for every person to go through it." (m, Kenya)*.

4.2.2. Key Themes Focusing on the Countries with the Top Three Most Positive and Negative Perceptions of Puberty

Qualitative data were further analyzed in terms of the highest-placed three countries with the most positive and negative puberty perceptions (based on the conceptual grouping approach mentioned above) for males (Table 4) and females (Table 5) separately. Therefore, in the following section, we focus on the personal perceptions of puberty in the format of qualitative statements of males from India, Brazil, and Ghana (positive) *vs.* Kenya, Poland, and Turkey (negative), and of females from Ghana, Bulgaria, and China (positive) *vs.* Germany, Iran, and Poland (negative).

Table 4. Respondent Quotes from selected Countries - Male.

Most Positive Perceptions of Puberty	**Quotes**
India	Positive feelings/pride – "Because it is something to be proud of" (m) Normal/natural – "Because it can't occur in our body with a medicine. It grows naturally" (m) Physical strength and growth – "Firstly, when I was a kid, everybody was small in height, but now as I grow to a teenager, I have grown stronger and now nobody can hit me and now I am tall also" (m) Sexual maturity – "Because in my point of view, I don't think puberty makes me weak. Sex is good for health" (m)
Brazil	Positive – "It is positive because I need it if I have a problem" (m) Universal – "Because everybody will go through it" (m) Person, personality change – "Because you became a better person" (m) Positive effects – "It makes me strong because me in puberty, I feel secure and protected" (m) Negative effects – "It makes me sad, I know I am getting older" (m) I don't know – "Because I do not know what it is" (m)
Ghana	Shows growth – "It makes people see that the person is growing into an adult" (m) God-created – "It is natural because God has made it so" (m) Universal – "It happens to everyone" (m) Normal – "It is a normal part of every normal person's development" (m) Stronger, healthier, energetic – "The more my body develops, I get stronger and more active" (m) Growth – "Because I know I am growing" (m)
Most negative perceptions of puberty	
Kenya	Normal/universal – "Because it is a must for every person to go through it" (m) Positive feelings/consequences – "Causes good things and also embarrassing things" (m) Positive consequences – "Makes me a grown-up" (m) Negative feelings – "I get sick in my mind" (m) Character development – "Because when you get at it, you must learn to listen to what elders tell you" (m) Both positive and negative – "Sometimes I feel very weak and other times very strong" (m) Eat a lot of food – "You eat a lot of food" (m)
Turkey	Negative aspects – "It is negative because physical changes (acne *etc.*) are bad things" (m) Necessary period – "If this period did not happen, we would have some problems" (m) Good thing – "Because it is a good thing" (m) Universal, everybody goes through – "Because everyone experiences this period" (m) Positive and negative – "It makes us both stronger and weaker" (m)

	Negative – "I am demoralized when I have acnes" (m)
Poland	Growth – "You are bigger and you can't do some things you used to do before" (m) Change – "Because they change and it's a difficult period" (m) Negative consequences – "Because you can [or may] have self-esteem issues [complexes]" (m) Depends on the person – "It depends on a person, sometimes it's one way, sometimes it's the other" (m) Irritated – "All the time irritated [under pressure], everything irritates me" (m)

Based on this inspection, positive connotations of puberty in males are associated with feelings of pride and strength, perceptions of a normative body transition, and universality in life. Negative perceptions of puberty in boys, in turn, seem to be related to embarrassment, sickness, difficulties, and new, challenging roles, and the development of problem behaviors. For females, the positive connotation of puberty is linked with pride regarding the body and newly acquired adult status and physical development, such as breast development, self-enhancement and power. Their negative perceptions of puberty, in contrast, are associated with negative reflections on increasing moodiness, less confidence, physical changes, in particular menstruation and pimples, which seem not to be welcomed.

In sum, the exploration of the themes and examples around puberty, and the physical changes related to it in the eyes of adolescents in diverse cultural contexts (aim 2), revealed outstanding insights into the psychosocial mechanisms of adaptation for males and females. The focused inspection of the populations with the most positive *vs.* negative perceptions of puberty and physical changes based on qualitative data supports cross-cultural and gender-specific differences in the psychological reactions of youth to puberty and their underlying developmental mechanisms.

Table 5. Respondent Quotes from selected Countries - Female.

Most Positive Perceptions of Puberty	**Quotes**
Ghana	Positive in various ways – "It helps you to know yourself better" (f) Natural – "As an individual puberty is a natural thing to experience" (f) God-given – "Because god created it for humans" (f) Important for adulthood – "Without it we wouldn't have adults" (f) Shows growth – "Is a process which shows that one is growing" (f)
Bulgaria	Weak and strong – "In my menstrual period am sometimes weak but when am not in my period I am strong" (f) Weakness – "Because you can get regular pains at times and excessive energy" (f) Positive change in behavior – "I tend to stop childish behaviors and become careful about myself" (f) It's good – "I think it is good" (f) Positive development – "Because of the development, it is always positive" (f) Natural – "It is natural to grow up" (f) Part of life – "Because it is a part of our life" (f)
China	Body growth and development – "My body gets bigger" (f) Responsibility – "My responsibility grows" (f) No difference – "It has no difference with before" (f) Good changes – "It means I have grown up. It is positive and negative. But it is more positive for me" (f) Necessary experience – "Adolescence is one who must experience" (f) Body development – "Because of the breast growth" (f) Growth – "Because I have grown up" (f) Mental change, independence, confidence – "Adolescence can make the person become independent and more powerful" (f)
Most negative perceptions of puberty	
Germany	Good and bad – "Sometimes it's good, other times not, because there are good and bad changes" (f) Natural and normal – "Because it is normal" (f) Negative change in personality and body – "Because you get your period and have a bad mood" (f) It is universal – "Because it is so for everybody" (f) Unavoidable – "Because you can't fight it..." (f) Normal individual development – "Because everyone has or had it, it's normal" (f) New challenges – "Because you have to adjust to certain things" (f)
Iran	Negative changes – "I hate becoming pimples" (f) Positive development – "More positive because I can understand more things than before" (f) Happy growth – "Because of its beautiful and interesting feeling" (f) Don't want to grow – "I never wanted to be in this age" (f) Natural/God-given – "God wants it for us, so there will be a difference between adult women and other women" (f) Positive body change – "The Power of my arms and brain has increased rapidly" (f) No changes – "I have not changed" (f)
Poland	Negative consequences – "Changes have made me less self-confident" (f) Positive development – "I'm more grown-up, I'm more independent" (f) Negative aspects – "I start to use vulgarisms, to shoot my mouth of, I'm getting a period" (f) Necessary – "You need to go through it, so the only question is if we like it, I personally don't really like it" (f) Everybody goes through it – "Because everyone will be mature as an adult" (f) Normal, happens automatically – "Because no one invented it, it exists and that's it" (f) Preparation for future life – "It prepares you a little for work" (f)

5. Discussion and Conclusions

Using a mixed-methods approach, the overarching aim of the study was to investigate adolescents' personal perceptions of puberty across 16 diverse cultures from four continents. Therefore, an emic and exploratory research approach, including qualitative statements' analyses, was used to draw the first picture of the individual responses to the universal event of puberty, which has not been investigated before. With this study, we align with the current plea for research on puberty incorporating an intersectional understanding framework [5,6], which advocates for the use of data collection methods that capture nuances and variations of the pubertal experience via qualitative and mixed methods with increased use of open-ended questions, and cross-cultural research in collaboration with researchers from within the contexts studied. Also, we were able to broaden the lens to include understudied populations within puberty research, *i.e.*, boys and ethnically diverse samples [2].

Descriptive analyses showed that the countries from the Global North and South were diverse with regard to many macro-contextual characteristics, most importantly in shared values, access to and distribution of sex education, favored body ideals, and the existence of puberty rites. The highest cultural diversity was found in India, Iran, Kenya, and the U.S., and the lowest was found in Poland and Portugal (followed by Bulgaria, Japan, Lithuania, Portugal, and Turkey). The different (ethnic/religious) groups are very separated in Brazil, as well as in Bulgaria and Japan, and very mixed in China. Most people in Brazil, Ghana, Japan, Poland, and Turkey have a strong autocratic culture, whereas people from Ecuador, Germany, and the U.S. have a weak autocratic culture. A very low tolerance of ambiguity was found in Portugal, and a high tolerance of ambiguity in Brazil. Boys and girls from China are not allowed to have romantic and sexual experiences during puberty at all (in contrast to German and Bulgarian adolescents), whereas Ghana and Poland differ strongly between the sexes. For males in Japan and females in Ecuador, Japan, Lithuania, and Poland, a very slim body shape as an ideal of beauty is endorsed, while for males and females from Ghana, the preferred body shape of moderately overweight was the predominant beauty ideal. Half of the schools provided sex education as part of their curriculum. In Bulgaria and India, none of the students in our sample participated in any puberty rite. In contrast, in Brazil, Iran, and Kenya, an average of just under 40% of students took part in puberty rites.

Main analyses of this study revealed significant variations and similarities in experiences and personal perceptions of puberty among girls and boys from different cultural backgrounds. While the physical changes of puberty are universal, the reflections and personal interpretations of the adolescents themselves vary both across and within cultures and by gender, highlighting highly individualized experiences of puberty [23]. Similarly to previous research, positive themes of strength, universality, and growth predominated across the study contexts. Conversely, negative themes of shame, expectations of problematic behavior, and the emergence of challenging new roles and statuses were also emphasized by the youth and were associated with puberty [39,67–69]. In addition to the positive and negative perceptions of puberty, others mentioned the mental, behavioral, and emotional changes, as well as physical growth. Such perceptions are particularly relevant during puberty. At this time, culturally embedded gender stereotypes contribute to the manifestation of self-reflection and self-evaluation [70], which, in turn, are correlated with health and problem behavior, such as depression, in and throughout adolescence (*e.g.*, [23,71]).

5.1. Insights into Culturally Anchored Developmental Mechanisms to Positive and Negative Perceptions of Puberty

Particular negative perceptions of puberty in males and females were found in some countries of the Global North and the Global South, including males in Kenya, Poland, and Turkey, and females from Germany, Iran, and Poland. This supports the view that the Global South *vs.* Global North categorization is overly broad and that each country provides unique contexts for adolescent development. These unique contexts, by their specific characteristics, can influence personal perceptions of youth on puberty via proximal mechanisms, for instance, through prior preparation and knowledge, [23] with the negative perceptions spurred by cultural myths, misconceptions, and misinformation [67], or reactions and messages received from proximal social contexts to physical changes in puberty [18,22]. These perceptions, in turn, are highly relevant to implications for adolescents' mental health and well-being [23,31]. This argumentation suggests that, for instance, the transfer of knowledge about pubertal development (*e.g.*, as conveyed through sex education in schools) is assumed to be critical for fostering readiness and positive attitudes towards puberty. Sex education is normatively present in schools across the countries of this study, even for youths with the most favorable and the most unfavorable personal perceptions of puberty (*e.g.*, Ghana *vs.* Germany, for females). This suggests that the content of sex education and the way the facilitators (mainly teachers) react to adolescents during pubertal development may be more crucial than merely having sex education included in the school curriculum (*c.f.* [3]), and that this aspect does not solely lead to a positive perception of puberty. In fact, the content, quality, facilitation,

and scope of sex education vary widely by country and by school, and most often lack the necessary psychological dimensions and social context coverage, which renders them ineffective [30,43]. In addition, in the majority world, sex education programs focus narrowly on menstruation and HIV AIDS, neglect the promotion of positive attitudes towards physical changes in puberty, primarily target females, and are often not evaluated for effectiveness [30,72].

Thus, it is plausible that additional macro-contextual factors above and beyond sex education in school also influence adolescents' perceptions of pubertal development, such as puberty or coming-of-age rituals, which are often intended to support and ease the pubertal transition [20,21]. However, for the mere existence of puberty rituals in the respective countries, no clear link emerged to very positive or negative personal perceptions of puberty as seen by adolescents (*i.e.*, the countries with the most prominent existence of puberty rituals are not the ones where adolescents have the most positive personal perceptions of puberty). This finding suggests that the characteristics of the rituals likely play a role, too (*e.g.*, whether the ritual is self-selected, meaningful, harmful, or associated with pride or shame; see [21]).

Additionally, beauty ideals seem potent in shaping personal perceptions of puberty development. Our data highlighted Ghanaian girls, whose perceptions of puberty were positive, feeling that puberty makes their bodies strong and beautiful, in contrast to girls in countries who rated puberty as "negative", "weak", or "ugly" (*e.g.*, Germany, Poland, Iran, or Japan). Ghana is known to endorse somewhat fuller body figures as a standard of beauty than in the Global North, also in the current study (see descriptive findings; [73,74]). Via media influences, messages, and social reactions, this can contribute to a positive attitude towards physical changes in puberty, such as more feminine body silhouettes. These processes are also relevant for males and must be studied in greater depth. Applying this to practice, in particular school-based intervention strategies, such as communicating more realistic body ideals, strengthening positive body image and self-confidence, and empowering boys and girls in general before and during puberty, is important to promote positive development. The implementation of such intervention strategies is most needed in countries such as Iran, Germany, Kenya, Poland, or Turkey.

In addition to the differences between the sub-samples, the current study revealed marked similarities in adolescents' experiences and perceptions of puberty worldwide, *e.g.*, perceiving puberty as associated with positive aspects, appreciating puberty for gains in growth and physical and psychological strength, and accepting puberty as a normal and universal aspect of the life cycle. These findings lend credence to the view that as adolescents have been growing up in the era of global digitalization [75,76], their lives and experiences across the world, especially for those living in urban settings, have become increasingly similar, as many adolescents from the Global South adopt attitudes and values from the media-dominant Global North [77], leading to shifts and the fading of differences in cultural and social contexts [78].

5.2. Strengths and Limitations

One of the strengths of the current study is the insight it provides into young people's personal, self-reflected perceptions of puberty from diverse cultural backgrounds around the globe, including countries from the often neglected Global South. These in-depth snapshots of adolescents' personal perceptions of physical changes in puberty in various contexts have the potential to inform future basic and applied research. Also, the combination of quantitative and qualitative data, along with intensive collaboration with local researchers in developing, translating, and adapting measurement tools, conducting on-site data collection, and interpreting the data, are important assets of the research presented. Another major strength is the innovative research strategy, using broad, evaluative questions (semantic differential), which were then supplemented by qualitative statements to give adolescents from different cultural contexts a voice (c.f., [5,6]). In addition, the total sample size of N = 715 is impressive, given that on all 16 sites, qualitative data were gathered, coded, and analyzed, on average on 45 boys and girls. Usually, much smaller samples are investigated in puberty by applying qualitative research methods (*e.g.*, [22]).

Nevertheless, the results of this study should be considered within the context of several limitations. First, the data were gathered only in one urban school setting per country. This further emphasizes the need for larger samples that include several schools (urban/rural) to allow for the generalizability of findings within the respective country. In rural contexts, the differences detected between countries might even be pronounced due to a smaller impact of globalization effects and higher traditionality. In this context, however, it is important to mention once again that the present study is explorative and meant to provide a snapshot of adolescent pubertal experiences. It has not aimed for representativeness or explicit statistical significance. As a subsidiary analysis, however, the main and interaction effects of country and sex were tested post-hoc in ANCOVA analyses. Results indicated the statistical significance of the main (country, gender) and interaction (country x gender) effects on the personal perceptions of puberty. This suggests that the

conclusions of this study have an impact. Nevertheless, due to the small sample sizes of males and females investigated in each country, we should be careful regarding interpretation, and further research would require larger, representative samples in each country involved (*e.g.*, [79]). Second, the country- and school-specific data can only provide an initial view on cultural factors shaping adolescents' perceptions of puberty (*e.g.*, beauty ideals and sex education, as reported by local colleagues), which should be studied in greater depth in further research. This could be realized, for instance, through adolescents' self-assessment of body image/ideal beauty. Third, the content and scope of puberty and sex education in (and outside) school would be of great importance in this context to identify what particular content is associated with a positive/negative perception of puberty. Fourth, cultural aspects are transmitted to individual development via proximal social experiences and responses and messages received in the family or peer context that are known to shape personal perceptions of puberty (*e.g.*, through negative comments about weight or height increase by peers). Although it was not the goal of this study, we analyzed additional data on the perceived reactions to puberty of parents, siblings, teachers, and peers as reported by the adolescents of our sample. These additional analyses showed impressively that adolescents' positive/negative personal perceptions of puberty systematically resemble their views on how close social interaction partners would react to puberty. Specifically, correlations between adolescents' personal valence and the perceived reactions from proximal interaction partners to pubertal changes indicate moderate correspondence (parents $r = 0.290$, $p < 0.001$; teachers $r = 0.285$, $p < 0.001$; siblings $r = 0.242$, $p < 0.001$; and friends $r = 0.361$, $p < 0.001$). For instance, girls from Germany not only have the most negative evaluation of pubertal changes, but they also perceive that their parents, peers, and teachers react negatively to them, in contrast to girls from Ghana. This suggests an interaction between individual and social aspects of pubertal development, while considering that much of the positive and negative evaluation of puberty is influenced by the position in and responses from the peer group, family, and school context embedded within a particular culture. Consequently, further research will have to apply more in-depth and multi-informant measures on the proximal social mechanisms, in addition to broad assessments by the adolescents themselves.

5.3. Implications of the Study for Research and Practice

This exploratory study delivers an interesting snapshot of adolescents' personal experiences of puberty worldwide, thereby having the potential to inform further basic and applied research. Also, important information for the development and application of effective intervention strategies to promote positive development that are sensitive to gender and culture can be derived from this study. Generally, insufficient information on puberty has been linked to adolescents' negative perceptions and experiences [8,23]. A research review of puberty education programs showed that due to the scarcity of evidenced-based puberty policies and programs around the world [30], parents and schools (teachers) face increasing pressure to step up and fill the knowledge gap [35,37,80]. In fact, a large part of knowledge transfer takes place in sex education at school, but puberty education programs delivered by teachers, social workers or external prevention experts must go beyond sex education by conveying puberty-specific knowledge (*e.g.*, physical development, menstruation) and focus in particular on promoting skills to deal with puberty-related changes and problems (*e.g.*, weight gain, mood swings), combined with general empowerment of youth [3]. These programs need to be positively themed around the ideas of positive body image, self-confidence, growth, and normality [30] in a developmentally appropriate and culturally relevant way [37], to promote positive psychosocial development in and beyond puberty. In the same vein, in particular in regions with negative perceptions of puberty and pubertal changes by boys and girls themselves and their social environments (males: Kenya, Poland, Turkey; females: Germany, Iran, Poland), parents and teachers must support and empower boys and girls during this life period, appreciate growth, development, and "celebrate" the transition to adulthood as a positive milestone in humans' lives, instead of conveying the impression of puberty as a dangerous threat associated with the emergence of problems to be ashamed of.

Moreover, this study also has implications for future research on puberty. Given that most Euro-American theories on adolescent development are based on the premise that this developmental period is characterized by personal choice and autonomy, whereas much of the rest of the world is being led by values of social obligations and relatedness, care must be taken with mass exporting of theories and interventions to the Global South [81]. For societies that have them, puberty rites of passage were seen as an opportunity for relaying information about puberty and other culture-specific traditions to the next generation of young people. Some researchers argue that the current absence of such rites is creating a gap in knowledge transmission that schools and parents have been unable to address [82]. However, puberty rites, if reintroduced, must be voluntary, non-harmful, and efficient in the transmission of culture-affirming puberty education [21].

Adolescents of the Global North and South make up one-sixth of the world's population [83]. Access to education, knowledge, and health services, as well as enduring support by parents and teachers for adolescents, must be prioritized to ensure a smooth transition through puberty and promote unhindered physical, socio-emotional, neuropsychological, and cognitive development and well-being across the globe [81]. The findings of the present study can help focus on this vision by providing valuable insights into how adolescents around the world experience puberty.

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Author Contributions

K.W. conceived the study, its design and coordination. S.M. and N.F. performed the statistical analysis. K.W., N.F. and S.M. drafted the manuscript. M.N.N. helped to draft the manuscript and commented on previous versions. All authors read and approved the final manuscript.

Ethics Statement

This study was performed in line with the principles of the Declaration of Helsinki. The questionnaire and methodology for this study were approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences of the University of Jena (Ethics approval number: FSV 16/11; Date of approval: 2 August 2016).

Informed Consent Statement

Informed consent was obtained from all subjects (participants and their parent or legal guardian) involved in the study.

Data Availability Statement

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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