



ORIGINAL ARTICLE

ContinuumAEP and the acquisition of competencies in Pediatrics



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KEYWORDS

Competency-based education;
Curriculum;
Continuing education;
Distance education

Abstract

Introduction: According to the Global Pediatric Education Consortium (GPEC), paediatricians need to acquire and maintain a set of competencies in their daily practice. *Continuum*, the online training platform of the Spanish Association of Pediatrics, has developed training activities to explore and achieve these competencies.

Methods: Cross-sectional study of the training activities delivered on Continuum over eleven years and the competencies assigned to each of them. The period 2013–2024 was analysed through a descriptive analysis of competency coverage.

Results: A total of 12 048 GPEC competencies were assigned to 1118 training activities, with an average of 10.8 competencies per activity. Of the 8509 competencies available in the Continuum competency matrix, 5718 were addressed at least once. This amounts to 67.2% of the total (95% confidence interval [CI], 66.2 %–68.2%). Each competency was assigned an average of 2.11 times (95% CI, 2.07–2.15). There was considerable heterogeneity in the coverage by area of competence. We ought to highlight the high coverage (>90%) for the areas of “Professionalism”, “Patient Safety and Quality Improvement”, “Musculoskeletal Disorders”, “Allergy”, “Dermatology” and “Nutrition” and the low coverage (<10%) for “Self-Leadership and Practice Management” and “Gynecology”.

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PALABRAS CLAVE

Educación basada en competencias;
Currículo;
Educación continuada;
Educación a distancia

Conclusions: In the period under study, the *Continuum* platform enabled the attainment of more than two-thirds of the competencies required for pediatric practice as established by the GPEC. We identified asymmetries between knowledge areas. These should be considered to prioritize access to underrepresented competencies.

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ContinuumAEP y la adquisición de competencias en Pediatría**Resumen**

Introducción: Según el Consorcio Global de Educación Pediátrica (GPEC), los pediatras necesitan adquirir y mantener en su práctica diaria una serie de competencias. *Continuum*, la plataforma de formación en línea de la Asociación Española de Pediatría, ha desarrollado actividades formativas para explorar y obtener estas competencias.

Métodos: Estudio transversal de las actividades docentes impartidas en *Continuum* durante once años y las competencias asignadas a cada una de ellas. Se analiza el periodo 2013–2024 mediante un análisis descriptivo de la cobertura de competencias.

Resultados: Se asignaron 12 048 competencias del GPEC a 1118 actividades docentes, con una media de 10,8 competencias por actividad. De las 8509 competencias disponibles en la matriz de competencias de *Continuum*, 5718 fueron abordadas al menos una vez. Esto representa el 67,2% del total (intervalo de confianza del 95% [IC95] 66,2 a 68,2%). Cada competencia se asignó en promedio 2,11 veces (IC95: 2,07 a 2,15). Se observó una importante heterogeneidad en la cobertura por áreas. Destacan la alta cobertura (>90%) de las áreas de “Ética en la práctica clínica”, “Profesionalismo”, “Seguridad del paciente y mejora de la calidad”, “Trastornos musculoesqueléticos”, “Alergia”, “Dermatología” y “Nutrición” y la baja cobertura (<10%) de “Autoliderazgo y gestión de la consulta” y “Ginecología”.

Conclusiones: En el periodo analizado la plataforma *Continuum* ha permitido obtener más de dos tercios de las competencias necesarias para el ejercicio de la pediatría según GPEC. Se objetivan asimetrías entre áreas de conocimiento. Estas deben ser consideradas para priorizar el acceso a las competencias subexpuestas.

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Introduction

Competency-based education (CBE) is an educational approach based on the application of specific knowledge, skills and attitudes, replacing traditional education based on the delivery of theoretical contents. This is a student-centered approach that places the responsibility of learning on the students, who are required to demonstrate their ability to perform and apply competencies successfully.^{1,2}

Remote learning, facilitated by emerging technologies, is an efficient modality that students can adapt to their own needs.³ In 2013, the Asociación Española de Pediatría (AEP, Spanish Association of Pediatrics) launched *Continuum*, an e-learning platform based on CBE. It hosts numerous educational activities designed to develop the competencies (knowledge, skills and attitudes) that pediatricians need in their daily practice. The available contents are structured into various activities (“Training Courses”, “New in the Literature”, “Highlighted Articles”, “Image of the Week”, “Interactive Clinical Cases”, “Learning Capsules”, “Tools”). They are articulated as educational modules developed to cover a predefined spectrum of skills that,

together, have allowed the development of a matrix or framework underpinning the educational structure of *Continuum*.

The *Continuum* competency matrix was developed based on the collection of documents published by the Global Pediatrics Education Consortium (GPEC).⁴ This consortium is composed of leaders of 20 national, regional or international organizations devoted to education, training and accreditation in the field of pediatrics. At the same time, it assesses their efficacy with the aim of guaranteeing high-quality learning at the global level. The *Continuum* competency matrix is an original and standalone database. It holds more than eight thousand elements assigned to a hierarchical coding system to facilitate the management of the competencies involved in each learning activity. This design helps avoid the confusion and aimless rambling that can occur when attention is focused on process without first defining a clear destination or outcome.⁵

In this original article, we present and describe the GPEC pediatric competencies on which training and education is offered through the *Continuum* e-learning platform since its inception. The aim was to estimate the coverage of the GPEC

curriculum overall and by type of activity and knowledge area. We also sought to describe the profile of the platform users and the rate of engagement and completion for the offered activities.

Methods

We conducted a cross-sectional and descriptive study of the training activities and competencies offered and delivered through the *Continuum* platform in the 2011–2024 period. A full description of the platform is available in previous publications.^{6–8}

Study variables

- Competencies included in the syllabus of the GPEC: included in a database in which each of them is identified through a structured alphanumeric code that refers to distinct areas (core abilities and behaviors; core skills; core knowledge and patient care syllabus), subareas (organ- and body system-based issues; acute, critical and emergency care; palliative, surgery, rehabilitation and sports medicine; developmental issues; adolescence and related issues; issues of abuse; community and preventive issues) and type of competency (history, physical examination, diagnosis, management plan). “Core abilities and behaviors” encompasses the general competencies required for the practice of medicine and pediatrics, while “core skills” encompasses common procedures in pediatric care applicable to different specialties. The database is available through the “Matriz de Competencias” (Competency matrix) page of the *Continuum* platform.⁹
- Training activities in the platform; we collected their names and characteristics:
 - Image of the Week (*Imagen de la Semana*): published weekly. Images related to common diseases that are encountered frequently in clinical practice to expand the visual inventory of pediatricians.
 - Interactive clinical cases (*Casos Clínicos Interactivos*): published every two weeks. A real-world clinical case in primary care and in hospital-based care is presented to promote clinical reasoning skills, with particular emphasis on differential diagnosis and the selection of diagnostic tests.
 - New in the literature (*Novedades Bibliográficas*): published every two weeks. This section presents a recently published article to offer a review of the studies offering the most ground-breaking findings or that can be particularly significant due to the clinical relevance of their results.
 - Highlighted articles (*Artículos Destacados*): published twice a month. The entry provides a link to an article published by one of the leading Spanish pediatric journals (after obtaining the journal’s authorization).
 - Learning capsules (*Píldoras Formativas*): no set publication schedule. Brief activities that promote self-learning on very specific subjects.
 - Training courses (*Cursos de formación*): no set publication schedule. Predominantly developed by the different societies and committees affiliated to the AEP.

- Other available educational contents: “Preparing my rotation in...” (*Preparo mi rotación por*), “Tools for clinical practice” (*Herramientas para la consulta*) and “Library” (*Biblioteca*).

- Assigned competencies: before developing the training activities, the authors receive a list of GPEC competencies related to the topic at hand. Each developed learning activity is assigned an alphanumeric code for its identification. After completing each activity, the editorial board of *Continuum* designates the competencies that were actually covered in it. When the competency is not one of the competencies outlined in the GPEC framework, new competencies are defined and designated. The number of competencies assigned to each activity depends on its type and contents. Students that complete a training or course must pass an assessment test (with at least 70% of correct answers out of a total of 20–30 questions with four possible answer choices, of which only one is correct), with a limited duration (two minutes per question) and two opportunities for passing. The quality of the activity is assessed by means of a quantitative satisfaction questionnaire provided to the students for its completion.

Competency tracking

Continuum activities are presented in reverse chronological order. The matrix allows the user to identify the competencies and check the activities that the platform offers to acquire them.

Once the student passes the final assessment for an activity, this activity and the acquired competencies are added to the student’s training portfolio. Users can check which activities they have completed successfully at any time and browse their e-portfolio to determine which competencies they have acquired in each area and which remain to be acquired.

Statistical analysis

We conducted a descriptive analysis of the completed activities, the associated competencies and the participating students. We analyzed the coverage of competencies by area, subarea and type of competencies for the different types of activity. We estimated proportions for qualitative variables and measures of central tendency and dispersion for quantitative variables. We calculated the 95% confidence interval (CI) for the main estimates.

Results

Description of activities, authors and users

A total of 1118 activities were offered during the study period. The distribution by type of activity was: training course, 45; new in the literature, 211; images of the week, 469; interactive clinical scenario, 214; highlighted articles, 168; learning capsules, 11. These activities were developed by 2351 authors. *Continuum* also offered links to 2080 documents, 173 tools and 8 modules of “I prepare my rotation

Table 1 Assigned competencies by type of activity.

Type of activity	n	%	Total competencies	Mean by activity
Images of the week	469	41.9	1523	3.2
Interactive clinical cases	214	19.1	2684	12.5
Learning capsules	11	1.0	127	11.5
New in the literature	211	18.9	1122	5.3
Highlighted articles	168	15.0	1797	10.7
Training courses	45	4.0	4795	106.6
Total	1118	100.0	12 048	10.8

Table 2 Distribution of competencies by type of competency.

Type of competency	n ^a	%	Assigned ^b	%	Sum ^c	Mean ^d
<i>Core abilities and behaviors</i>	334	3.9	202	60.5	299	1.5
<i>Core skills</i>	120	1.4	63	52.5	183	2.9
<i>Core knowledge and patient care syllabus</i>						
History	2410	28.3	1635	67.8	3329	2.0
Physical examination	1298	15.3	924	71.2	2064	2.2
Diagnosis	1583	18.6	1156	73.0	2766	2.4
Management plan	2620	30.8	1660	63.4	3306	2.0
Common competencies	144	1.7	78	54.2	145	1.9
Total	8509		5718	67.2	12 092	2.1

^a Number of competencies available in the matrix.

^b Number of competencies assigned to *Continuum* activities.

^c Sum of competency assignments.

^d Mean number of assignments per competency.

in...”, which are not included in the platform’s competency database.

A total of 22 342 students were registered in the platform, of who only 9936 were members of the AEP (44.4%). In 2024, a total of 2396 students signed up for courses, of who 1287 (53.71%) were residents. A median of 317 students registered for each course (Q1, 233; Q3, 454); 80% completed all the modules, out of who 99% passed the assessment test upon completion.

A total of 12 048 competencies were assigned to the activities offered in the first eleven years, with a mean of 10.8 competencies per activity. Table 1 presents the results of the analysis of the competencies by type of activity.

Offered and delivered activities

A total of 12 048 competency assignments were made, with an average of 10.8 competencies per activity. Table 1 presents the analysis of competencies per type of activity. Of the 8509 competencies included in the matrix (216 were newly defined), 5718 were addressed at least once in the *Continuum* activities. This amounts to 67.2% of the total (95% CI, 66.2%–68.2%). Each of these competencies was assigned a mean of 2.11 times (95% CI, 2.07–2.15; median, 2; range, 1–18; interquartile range, 2). Table 2 presents the distribution by type of competency.

Table 3 shows the competencies covered by *Continuum* activities by content area. The mean competency coverage by content area was 60.9% (95% CI, 54%–67.8%; median, 64.1%; range, 4%–100%; interquartile range, 35.6%). Table 3

also reflects the total number of competency assignments, taking into account competencies that were assigned to more than one activity.

Discussion

During the study period, *Continuum*, the online education platform of the AEP, offered 1118 activities to 22 342 users. A total of 5718 competencies were covered, enabling the development of more than two-thirds of the competencies proposed by the GPEC curriculum standards.⁴ To understand the magnitude of this figure, we must consider the large number of competencies proposed by the GPEC, many of which are repeated or diversified in different content areas (specialties) and types of competencies (history, physical examination, diagnosis, management plan). In comparison, other training curricula for general pediatrics, such as those developed by The Royal College of Paediatrics and Child Health or the American Board of Pediatrics, have far fewer elements.^{10–13}

It is known that e-learning can complement formal in-person education during medical school,¹⁴ specialty training or clinical practice,¹⁵ especially in areas that tend to not be covered in depth¹⁶ or that are highly specialized.^{17,18} It is also useful for clinical scenarios that require standardized management, as it can improve the confidence of residents and adherence to clinical practice guidelines.^{19,20} In spite of this, there is still little objective evidence on the potential advantages of remote learning. Its effectiveness and impact on the performance of health care professionals and, to the

Table 3 Assigned competencies by content area and subarea.

Areas and subareas	n ^a	%	Assigned ^b	%	Sum ^c	Mean ^d
Core abilities and behaviors						
1. Ethics in practice	31	0.4	29	93.5	61	2.1
2. Collaboration	13	0.2	2	15.4	3	1.5
3. Global health awareness	57	0.7	30	52.6	36	1.2
4. Patient safety and quality improvement	47	0.6	47	100.0	56	1.1
5. Research principles and evidence-based practice	63	0.7	23	36.5	32	1.4
6. Scholarly activity	25	0.3	15	60.0	22	1.5
7. Self-leadership and practice management	18	0.2	1	5.6	1	1.0
8. Communication and interpersonal skills	16	0.2	3	18.8	4	1.3
9. Health advocacy and children's rights	23	0.3	9	39.1	16	1.8
10. Professionalism	41	0.5	41	100.0	67	1.6
Core skills						
1. Assessment and diagnostic skills	43	0.5	23	53.5	101	4.4
2. Basic therapeutic skills	27	0.3	16	59.3	41	2.6
3. Basic procedural skills	49	0.6	24	49.0	40	1.7
Core knowledge and patient care syllabus						
<i>Organ- and system-based issues</i>						
1. Allergy	98	1.2	91	92.9	312	3.4
2. Cardiology	189	2.2	145	76.7	325	2.2
3. Dermatology	314	3.7	297	94.6	877	3.0
4. Endocrinology	320	3.8	263	82.2	576	2.2
5. Gastroenterology and Hepatology	269	3.2	191	71.0	521	2.7
6. Hematology	318	3.7	170	53.5	322	1.9
7. Immunology	105	1.2	74	70.5	188	2.5
8. Infectious diseases	833	9.8	528	63.4	1128	2.1
9. Metabolism	161	1.9	66	41.0	93	1.4
10. Musculoskeletal disorders	352	4.1	351	99.7	670	1.9
11. Neonatal care	182	2.1	102	56.0	201	2.0
12. Nephrology	300	3.5	250	83.3	495	2.0
13. Neurology	382	4.5	245	64.1	590	2.4
14. Oncology	212	2.5	174	82.1	369	2.1
15. Ophthalmology	139	1.6	116	83.5	229	2.0
16. Oral and dental	93	1.1	52	55.9	77	1.5
17. Otolaryngology	270	3.2	151	55.9	326	2.2
18. Pharmacology	72	0.8	33	45.8	85	2.6
19. Respiratory	322	3.8	250	77.6	598	2.4
20. Rheumatology	163	1.9	137	84.0	262	1.9
21. Urology	119	1.4	42	35.3	70	1.7
<i>Acute, critical and emergency care</i>						
1. Critical care in children	195	2.3	138	70.8	267	1.9
2. Critical care in neonates	586	6.9	301	51.4	556	1.8
3. Emergency medical care	138	1.6	102	73.9	248	2.4
4. Fluid, electrolyte and acid-based disorders of an emergent nature	96	1.1	68	70.8	140	2.1
5. Toxicology and poisoning emergencies	76	0.9	53	69.7	93	1.8
<i>Palliative, surgery, rehabilitation and sports medicine</i>						
1. Palliative care	107	1.3	90	84.1	190	2.1
2. Peri and post-surgical care	43	0.5	20	46.5	23	1.2
3. Rehabilitation	61	0.7	13	21.3	21	1.6
4. Sports medicine	209	2.5	149	71.3	197	1.3
<i>Developmental issues</i>						
1. Behavioral and mental health	174	2.0	115	66.1	262	2.3
2. Genetics	86	1.0	40	46.5	55	1.4
3. Growth and development	80	0.9	17	21.3	18	1.1
4. Language, learning and sensory disorders	83	1.0	75	90.4	133	1.8
5. Nutrition	193	2.3	191	99.0	432	2.3
6. Psychosocial functioning	66	0.8	41	62.1	54	1.3

Table 3 (Continued)

Areas and subareas	n ^a	%	Assigned ^b	%	Sum ^c	Mean ^d
<i>Adolescence and related issues</i>						
1. Adolescent medicine	175	2.1	117	66.9	170	1.5
2. Gynecology	95	1.1	4	4.2	9	2.3
<i>Issues of abuse</i>						
1. Child abuse and neglect	75	0.9	59	78.7	115	1.9
2. Substance abuse	115	1.4	14	12.2	14	1.0
<i>Community and preventive issues</i>						
1. Community pediatrics	32	0.4	7	21.9	11	1.6
2. Preventive pediatrics	157	1.8	111	70.7	246	2.2
Total	8508		5718	67.2	12 048	2.1

^a Number of competencies available in the matrix.

^b Number of competencies assigned to *Continuum* activities.

^c Sum of competency assignments.

^d Mean number of assignments per competency.

extent possible, the impact on patient outcomes, all need to be evaluated.³

Based on our findings, it is reasonable to state that *Continuum*, built on the foundation of its matrix of competencies, enables and facilitates online learning of pediatrics competencies. More than two thirds of pediatrics competencies have been covered by the platform in its first decade in operation. At the same time, the platform hosts and organizes the training portfolios of the users, providing them with logging and tracking tools. Thus, the training portfolio becomes more than a mere collection of evaluations and attendance certificates. It turns into an actual résumé that defines the strengths and weaknesses of both the user's training and the platform itself.

In addition, the aforementioned transition to competency-based education includes additional evidence through practical assessments within a progressive, inquiry-based and demonstrably competency-based learning plan.²¹ The *Continuum* competency matrix implements international standards for planning and implementing educational activities or courses. It promotes self-led learning, the development of clinical skills and critical thinking. There have been few previous similar experiences. Among them, we ought to highlight that of the Royal College of Paediatrics and Child Health, which has proven effective in the integration of standard curricula in e-portfolio training logs.^{10,21}

The main challenge in covering the competencies of the GPEC syllabus lies in their uneven development across different areas of learning. This means that areas with more detailed competencies that break into a larger total number of competencies which, therefore, require a larger number of specific training activities to cover them. This makes it difficult for the platform to homogeneously cover all the skills and specialties within pediatrics; a lower percent coverage of an area's competencies does not necessarily signal neglect of that particular area. To minimize this issue, *Continuum* structures and offers educational activities based on the different subspecialties of pediatrics.^{22–24}

This probably gives rise to some of the heterogeneity in the coverage of competencies. The diverse profiles of

the authors, combined with the variable contribution of the different committees and societies of the AEP, has influenced the achievements made in training. Thus, as would be expected, there is a correlation between the offered training courses and the degree of coverage of the competencies in their respective areas.

The content areas with the highest coverage (>90%) include "professionalism", "patient safety and quality improvement", "musculoskeletal disorders", "allergy", "dermatology" and "nutrition". These cross-cutting general competencies apply to different areas of pediatrics knowledge, which is why their coverage predominates. Since the platform does not have a permanent team of instructors, at the outset, the development of educational activities was not planned to follow a uniform distribution by content area. However, after periodic reviews of the platform's performance, it is possible to approach the development of new courses to cover underrepresented areas moving forward. The findings of our study can guide the optimization of the offered educational activities to learning areas that have not been covered yet.

We found differential behavior in activities such as "New in the literature" or "Highlighted articles". These were influenced by the recent publications in the medical literature. On the other hand, the "Image of the week" and "Interactive clinical case" authors were sporadic collaborators not affiliated with *Continuum*. Both of these sections directly reflect clinical practice ("submitting what is managed in the real-world care setting"). Their contents, which align with the digital format with the use of cutaneous or radiological images, contribute to increasing the coverage of diagnostic competencies.

This study has some limitations. Although the results of the analysis show the competencies that can be acquired through the activities on our platform, it was not possible to estimate with certainty the actual learning of our students. Completing any activity requires an assessment test, but this does not guarantee an actual clinical impact on patient care. Assessing this impact is one of the challenges we should undertake in the future. On the other hand, given the observational nature of the study and the design of the matrix, we were unable to consider aspects such as

whether the acceptance of training options is modified or influenced by the assigned competencies. We also could not infer whether students changed their training choices based on the absence or presence of specific competencies in their training portfolio.

In conclusion, the *Continuum* e-learning platform has made it possible to acquire more than two thirds of the competencies required for the practice of pediatrics based on the GPEC curriculum. Thus, the platform offers a broad range of educational activities that contributes to the development of an important part of the professional competencies in pediatric care and that support and facilitate continuing education. Still, we found imbalances in coverage between different content areas. These imbalances need to be considered to prioritize access to the under-represented competencies in the future development of educational strategies.

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CRedit authorship contribution statement

All authors contributed to the study concept and design. Materials were prepared and data collected and analyzed by all authors. Carlos Ochoa Sangrador and Carmen Villaizán Pérez wrote the first draft of the manuscript and all authors commented on this and subsequent versions of the draft. All authors read and approved the final manuscript.

Annex 1: Members of the *Continuum* Editorial Team

Directors: Javier González de Dios and Francisco Hijano Bandera. Coordinators: Alberto García-Salido, José María Garrido Pedraz, Rafael Martín Masot, Carlos Ochoa Sangrador, Esteban Peiró Molina, Manuel Praena Crespo, Carmen Villaizán Pérez and Pablo del Villar Guerra.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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