

財團法人黃昆輝教授教育基金會
2023-2024教育政策整合型專案研究報告

Professor Huang Kun-huei Education Foundation
2023-24 Integrated Research on Educational Policy

因材施教，成就每個孩子 — 台灣優質教育的願景與對策

提要

Empowering Every Child, Developing Talent
According to Aptitude — Visions and Strategies
for Quality Education in Taiwan

Brief

財團法人黃昆輝教授教育基金會
教育政策整合研究專案小組

2024年10月

Research Team of the Integrated Research on Educational Policy
Professor Huang Kun-huei Education Foundation

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壹、前言

本基金會自 2016 年創立以來，以「研究」、「獎優」、「扶弱」為工作主軸。其中，有關專案研究部分，強調以「專業」、「本土」、「實徵」、「前瞻」為特色的應用型學術研究，期能針對我國當前重要教育議題進行深入探討，然後能夠針對現存問題提出具體改進策略，以供政府參考。2018 年首以「邁向公義與卓越：臺灣教育發展的危機與對策」為題，經 18 個月研究，完成《邁向公義與卓越—臺灣教育發展的危機與對策研究》報告（黃昆輝，2019），再經過學術討會討論後，撰成《台灣教育危機報告書》，揭示臺灣教育面臨社會階層再製、教育品質平庸、人才培育失衡等三大危機，建議政府採取實現教育公義、提升教育品質及培育國家未來所需人才三大對策（財團法人黃昆輝教授教育基金會台灣教育危機報告書研撰小組，2019）。在前述基礎上，2021 年度，再以「新世代、新教育：社會變遷中的人才培育」為題，探究新世代人才亟需數位素養、民主素養及全球素養等三大素養，及與相應的科技教育、公民教育與國際教育，之後撰成《新世代、新教育—社會變遷中的人才培育研究》（黃昆輝，2022）。根據前兩項的研究發現，本基金會主張台灣未來教育永續發展必須秉持「公義」與「卓越」的核心價值，而此一理念要能產生實質成效，就需落實到學生身上。而此正是兩千多年以來孔子所主張的「有教無類、因材施教」的理想。據此，本基金會 2023 年度以「因材施教、成就每個孩子：台灣優質教育的願景與對策」為題，進

行 18 個月的整合型專題研究。

一、研究目的與重點

本研究的主要目的有六：

- (一) 探討因材施教的理論基礎。
- (二) 探討主要國家因材施教的作為。
- (三) 檢討我國推動因材施教的法制與資源配置的現況與問題。
- (四) 檢討我國推動因材施教的課程與教學之現況與問題。
- (五) 檢討我國應用數位科技於學習的現況與問題。
- (六) 提出落實因材施教具體策略與作為的建議。

依據上述研究目的，本研究之重點如下：

- (一) 理論基礎的探討：探討學生學習時存在的各種個別差異，進而說明因材施教的必要性與可能性，以及對教育的啟示。
- (二) 國際教育經驗的趨勢：探討主要國家推動因材施教的制度形成背景、進路分流的階段及輔導措施、特色與問題，及其趨勢與可供借鑑之處。
- (三) 法制與資源配置的檢討：分析我國在落實因材施教時，教育制度法規設計、學校師資人力配置及資源分配的實況與問題，提出改進策略。
- (四) 課程與教學的檢討：分析我國推動因材施教時的課程

發展與教學現況與問題，及影響實施成效因素，提出改進對策。

(五) 數位學習的檢討：檢討我國應用數位科技於因材施教的現況與問題，提出落實因材施教的改進對策。

在上述研究重點中，理論基礎一章，主要從認知面向、情意面向及生理與環境影響等三大方向，說明學生的個別差異及對教學的啟示，以為後續分析基礎。國際趨勢一章，主要探討「經濟合作暨發展組織」(OECD)的日、德、西、法、美、英等六國，因應因材施教時學制進路上如何進行分流及相關輔導作為、特徵與趨勢。法制與資源配置、課程與教學及數位學習等三章，均將針對我國教育實況，說明因材施教相關的政策演進、現況概述、問題分析以及對策建議等四方面。

二、研究方法與步驟

本研究主要採「實徵性研究」(empirical study)，兼合理論分析、文件分析、國際比較、問卷調查、焦點座談、專家諮詢、訪問等。研究所需實徵性資料來源包括：1. 官方教育政策及實務的相關檔案、法規文件、計畫、報告；2. 外國教育發展狀況相關資料；3. 國內外相關研究文獻；4. 應用自編問卷、訪談、諮詢、研討等方法蒐集的相關意見。各子題依其性質與需要，採用適切之方法進行資料搜集與分析。以下五章分別摘述五個子題的研究結果與發現。

貳、因材施教的理論基礎

教育需考量學生的個別差異，施予適性的教學內容、策略、管道，才有可能因材施教，成就每位孩子的潛能。因材施教中的「材」，係指學生內系統與外系統具有的個別差異。依「通用學習設計理論」，學生內系統差異包含認知面向（智力、認知風格、性向、執行功能）以及情意面向（性格與信念、學習動機、情緒）的差異。而依「社會系統理論」，外系統則主要指學生所處社會環境（性別、族群與文化以及家庭與學校）之差異。

在認知面向上，教學者應根據學習者的智力、認知風格、性向、執行功能等因素考量學生「能不能學習、適不適合學習」的個別差異。智力方面，智力三元論以及多元智能理論均強調智力是豐富多元的，並強調每位學生皆具有各種不同智能，只是程度上的差異，教育者應設計多元教學和評量，努力覺察學生的優勢智能，並透過鼓勵學習者運用優勢智能、強化非優勢智能，以達到智能均衡發展。此外，亦可根據每一學生的多元智能差異，微調教學方法、教學進度，達到因材施教的目標。認知風格是指學生偏好與習慣組織與表徵訊息的方式。教師所偏好使用的教學方式，不必然會對所有學習者都能產生有效學習；若教學者能認識到每位學生都有獨特的起點，並適性地根據學習者的認知風格或學習風格來進行教學設計，將可能會有更佳的學習成果。性向意指個體學習特定事物之前，即已具備對於學習該事物的潛在能力。針對此潛在能力的評估，有助於教師輔導學習者進行生涯探

索、教育安置或分流之參考，例如資賦優異學生之鑑定、升學類型學校（普通高中、綜合高中、高職）之輔導等。教學者亦可根據不同性向之學習者提供差異化的教學介入，有助於實現較佳的學習成效。執行功能係指個體在尋求與達成目標所需高層次認知能力（包括工作記憶、抑制控制、認知彈性、計畫等）。若某類執行功能受損則會造成特定的學習障礙。故應針對特殊需求者，教學者宜規劃適性的執行功能訓練，提升認知和學習表現。認知面向的因材施教，針對學生擅長及需要的領域中發揮所長，以實現優勢展才的目標。

在情意面向，教學者應依據學生性格信念、學習動機和情緒等因素，考量學生「願不願意學習、樂不樂意學習」的個別差異。性格係指個體穩定的思想、感受、社會適應和行為模式。教師應重視學生的性格差異，以人境適配的原則，針對低學習動機的學習者，使用適切的學習策略，提供更有效的輔導和支持，以促進其全面發展。信念係指個體對學習所抱持之價值、態度與期望，包括自我效能、自我概念和智力內隱信念等。這些信念對學習適應和學業表現均具有關鍵影響。因此，教學應針對低自我效能、低自我概念、持不同智力信念之學習者，引導學習者清楚認識與肯定自己、建立成功的經驗、提供學習者正向回饋和支持、有效管理情緒，注重多元參照的方式，採取個別差異教學策略，並提供心理輔導，以激勵學生更積極參與學習。學習動機係指學生對學習目標的關注和努力的程度。教學者應瞭解學習者動機，針對動機較弱、或持非適應性動機的學習者，調整教學策略。加強適

應性動機的培養，鼓勵積極與正向的學業情緒，提供支持性的學習環境，強調內在價值，以激發內在動機，促進全面發展。學業情緒係指學習者在學習時，因認知評估而產生的與課業活動或結果相關的各種情緒。教育者應適時覺察學生情緒狀態與表現，針對有情緒困擾的學生，提供差異化的支持，透過正向情緒有效調節情緒，幫助他們更好地應對學業壓力，發揮潛力。透過深入瞭解個體情意因素，制定更加適性與個別化的教學策略，創造一個支持性和激勵性的學習環境，可以幫助學生建立積極的心態、實現幸福健康的核心目標。

在社會環境面向，教學者也應考量學生性別、族群與文化、家庭與學校等因素是否「有利於學習、有助於學習」。在性別方面，教學者除了以性別敏感度教學方法，引導學生思考性別在不同面向對兩性的意義及影響外，亦應藉由發展系統性的性別平等教育方案提供兩性公平的學習機會與條件，避免性別刻板印象阻礙任何性別學生的學習表現。在族群與文化方面，臺灣係由多元族群所組成的社會，教師應提升文化敏感度，以提高學習投入度並減少文化偏見。並需關注不同文化學生的學習與適應，以文化回應的差異化教學，創造包容和平等的學習環境。在家庭與學校方面，家庭的條件以及學校的組織結構與教學氛圍對學生的學習有著直接的影響。故教師需運用差異化教學模式，讓不同程度的學生都能在原有基礎上有所進步，尤其能提升低能力學生的自信心和學習表現。此外，教師也可透過合作學習和善用社區資源，促進不同背景學生的學習成效。針對社會環境層面的因材施教，

有助於實現包容和公平的全民優質教育，讓每個人都能夠享有平等的學習機會，以達成公平正義的目標。

綜上所述，本節因材施教的理論基礎提供一個全面性的視角，以利全面地理解並應對學生在認知面向、情意面向與社會環境因素之個別差異。透過適性化的教學方法，能夠更有效地引導學生實現其潛能與優勢，培養學生的興趣和動機，進而發揮優勢展才、實現幸福健康、實踐公平正義的目標。

叁、因材施教的國際趨勢

本節透過比較分析日本、德國、西班牙、法國、美國及英格蘭等六個國家關於：1. 因材施教的理念、2. 進路分流的階段、3. 進路分流的輔導措施、4. 進路分流的特色、5. 進路分流的問題等五個面向，冀求透過對於其他國家相關教育制度內容之描述 (description)、詮釋 (interpretation)、併排 (juxtaposition) 與比較 (comparison)，提供詮釋與理解我國因材施教理念之比較視角，並供以因材施教理念為旨之教育改革實踐參考。

一、因材施教的理念

(一) 日本重視教育機會均等，對於「因材施教」（才能教育）並無共識，教育法規及行政制度上並無定義。若從課程教學面而言，則接近「個性化教育」或「個別

化教育」。

- (二) 德國傳統認為教育必須因應不同層才能與性向而進行「因材施教」，且從小學階段就開始進行分流。
- (三) 西班牙基於社會主義的傳統，較重視教育機會均等而在制度上無正式的分流制度，主要是透過課程差異化的方式進行適性教育。
- (四) 法國重視因材施教理念，並以「適應」、「分流導向」及「差異化教學」三方面來實踐。
- (五) 美國強調所有學生皆有接受優質公立學校教育的權利，冀望透過中小學教育使所有學生都能依照其天賦充分發展個人潛能。
- (六) 英格蘭傳統上階級問題嚴重，菁英教育的傳統導致從小學階段就開始進行分流。

二、進路分流的階段

- (一) 日本教育採取 6-3-3-4 制，從國中到高中的中等教育階段被視為是分流制度的開始。國中畢業生可以進入普通高中、職業高中或綜合高中，也可以進入高等專門學校（五年）與高等專修學校（3 年）。
- (二) 德國多數邦小學為 4 年，在進入中等教育前期時即進行學術型 / 職業型的分流。21 世紀以來分流型態從傳統三軌制（文理中學、主幹中學、實科中學）轉變為

文理中學與合併其中類型中學的「取代型第二軌」或「結合式第二軌」兩軌制。

- (三) 西班牙的教育制度在中小學階段為 6-4-2 制。分流制度主要是在前期中等教育 (3+1) 第 4 年所進行的生涯輔導課程及後期中等教育階段升讀大學的普通高中職業培訓為主之中級專業教育的分流。
- (四) 法國教育制度為 5-4-3 制，在中等教育階段開始實施升學的分流導向。初中第三年時學生必須在進入普通及科技教育或選擇職業教育之間做出選擇。而其進入後期中等教育階段時所採用的是以生涯輔導為理念，參照學業成績、性向與知識技能所進行的升學分流。
- (五) 美國並未有針對學術或技職教育所進行的分流，較常見的是因為學生的不同種族或能力差異進行能力分組並提供不同類型的課程。
- (六) 英格蘭主要分流有學術與技職兩軌。學生透過 16 歲時的「中等教育普通證書」(GCSE) 考試與 18/19 歲的「進階程度普通教育證書」(GCE, A Level) 進入高等教育學術機構。技職軌則是透過擴充教育、學徒制的資歷證書課程培養學生職業技能。

三、進路分流的輔導措施

- (一) 日本相當重視對於學生的升學就業輔導，1999 年後「進

路指導」課程成為中學校與高等學校全校性的教學活動。

- (二) 德國由於分流早，非常重視分流輔導。小學畢業後，教師依據能力與學習表現提供家長一份「升學建議書」以提供學生入學途徑參考，但家長仍有最後的選擇權。
- (三) 西班牙在前期中等教育階段第二年結束後啟動學生關鍵能力評估與輔導機制，針對學業表現不佳之學生採取課程差異化計畫及基礎職業培訓組來輔導學生進入職業培訓。
- (四) 法國學生在初級中學進入高級中學之分流導向，主要是透過學校教師對學生長時間連續觀察與學校全體教師及家長所組成之「班級代表諮詢審議會」做出主要的建議。
- (五) 美國學生選擇課程分流多是基於個人興趣、家長建議再加上學校授課教師與職涯導師所根據學生成就與個人特質所做的建議來決定。
- (六) 英格蘭的學校會根據各方考量，如學生背景、經費與師資等，開設不同的證書課程以滿足學生通過各項升學所需之課程、文憑與證書等條件的需求。

四、進路分流的特色

- (一) 日本因應個性最適合的學習（因材施教）強調培育未

來社會所需的資質能力、學校教育資訊化、指導個別化與學習個別化、充實學校與課程的管理，但更強調的是職涯教育的輔導。

- (二) 德國雖然從 10 歲即對學生進行分流，但其後不同學校類型彼此之間的「轉軌」相當暢通。且德國之職業教育具有較高的投資報酬率也弭平了學術與職業間的差異。
- (三) 西班牙正式制度上並無分流，但在前期中等教育第二年採用課程分流方式預防學生中輟，在最後一年進一步深化生涯探索以進行分流輔導。
- (四) 法國制定教育政策時會有因材施教之理念，並在學校層級實施有效、公平且適性的教育措施，教師於教學層次也都會注重到差異化教學。
- (五) 美國主要透過課程實施提供多元學習計畫與選修課程供學生選擇。而高等教育機構類型眾多且入學彈性，讓學生可依個人條件規劃學習。
- (六) 英格蘭給予中小學極大彈性辦學，各校可以因地制宜發展、多元複雜中學課程資歷，提供學生學校多元選擇。

五、進路分流的問題

- (一) 日本由於重視教育機會均等的前提，導致雙重特殊需求學生發展受限。

- (二) 德國由於及早分流導致不同類型學校成為了社會階級的標誌且產生了階級再製。
- (三) 西班牙具有社會主義傳統，較重視教育機會均等，且歷次教育改革會受到政黨政策左右。
- (四) 法國因材施教可能的問題在於分流早，不同類型的進路學校導致了社會階級的再製。
- (五) 美國因材施教的問題是學校並未提供客觀與一致的分流標準供教師使用。另外，能力分組強化學校內的種族隔離，對於經濟及文化不利學生的未來學業和職涯發展有負面影響，進而導致階級複製。
- (六) 英格蘭因材施教可能的問題在於分流早，不同類型的進路學校導致了社會階級的再製。

綜上，本子題之探討，總結如下：

1. 因材施教之理念會因歷史文化而有不同，惟以學生適性發展之目的之一致

各國對於因材施教之理念與實踐方式會因為其歷史文化之發展而有不同認知與做法，惟其目的均希望能協助每個人能如其所適地適性發展。

2. 進路分流之階段時間有先有後，惟均注重提供充分輔導諮商予家長參考

基於因材施教理念之差異使得各國在於學生進路分流的階段

年紀不盡相同，但透過多元管道提供家長選擇學生最適發展之輔導諮商為各國所重視。

3. 進路分流多軌緩急不同，惟均以終身學習為理念朝向便利轉軌制度設計

在終身學習理念與目標下，各國逐漸鬆綁學制，以更彈性、多元的方式提供學生更自主的學涯選擇。

肆、因材施教的法制與資源配置

為求聚焦，本研究著重學校制度與運作（含入學方式）、學校資源配置（含師資人力），以及學生輔導機制等議題。研究目的為：

- 一、剖析我國因材施教法規制度與學校資源配置的政策演進。
- 二、呈現我國因材施教法規制度與學校資源配置的實施現況。
- 三、探討我國因材施教法規制度與學校資源配置的實施問題。
- 四、分析我國因材施教在法規制度上與學校資源配置上可採行的因應對策。

本子題之研究，採用專家諮詢、訪談（含實體、線上，及電話訪談）、問卷調查等方法進行實徵資料的蒐集，並據以做為資料分析的參考。專家諮詢 3 位學者專家；實體、線上訪談不同縣市、職務、專長共 18 人；電話訪談縣市教育局（處）承辦年級

內分組學習的行政人員，共 11 縣市；及問卷調查 73 位國中校長針對分組學習提供意見。本研究同時運用質性與量化資料分析法，可能有地域的差異、訪談法，以及抽樣上的限制。以下分從政策演進、現況概述、問題分析以及對策建議四方面說明研究結果。

一、政策演進

學校制度和運作上，我國高國中小學校制度和運作的演進重點有，一、九年國民義務教育之奠基；二、強迫入學條例與國民教育法為義務教育之基石；三、系列教育改革啟動十二年國民基本教育；四、國高中升學制度轉變為「國中義務教育」與「高中多元入學」；五、暢通大學以前各學制升學管道，法規制度與轉銜機制；六、公私立學校設置，重視家長選擇權與學生學習權；七、弱勢學生、原住民族、新住民、實驗教育議題相關法規制度建立；八、弱勢學生的扶助及其升學制度的暢通，九、原住民族相關法規訂定與原住民族教育的落實；十、從新住民議題關注深化至新住民子女相關教育，以及十一、實驗教育的蓬勃發展為因材施教另一選項。目前法規仍持續更新與調整十二年國民教育相關配套措施。

學校資源配置顯現在師資人力、行政量能、經費分配、及學習資源等方向。師資人力擴充特殊需求師資與提高師生比；行政量能重視行政職員與兼職教師人力配置；經費分配透過憲法、教

育經費編列與管理法，與特定教育經費補助；而學習資源以《國民教育法》及相關辦法保障教與學品質。

學生輔導機制的發展分為學生學習輔導萌芽階段（2000年前），關注常態編班之分組學習、原住民族學生受教權益保障；學生學習輔導發展階段（2000年至2013年）強調學習扶助、弱勢族群；及學生學習輔導專業階段（2014年迄今），深化適性化學習扶助與三級輔導。

二、現況概述

學校制度與運作可從學校編班制度、分組/班學習、實驗教育，和升學制度與管道進行理解。學校資源配置在師資人力、行政量能、經費分配，和學習資源等方向。而學生輔導機制實施現況，可從學習輔導、生活輔導，與生涯輔導三方面加以了解。

三、問題分析

學校制度與運作的問題包括：(一)差異化學習扶助未能全面落實；(二)教育政策推動未配合學校實施現況；(三)年級內分組學習尚未能全面推動；(四)實驗教育之配套措施尚未落實；(五)公私立學校差異，不利因材施教在學校之落實；(六)高級中等學校多元入學與轉銜彈性不足；(七)一般教師的特殊教育知能仍待加強。學校資源配置的問題包括：(一)師資人力不穩定且代理教師比例偏高；(二)行政量能因固定教學時數之規定

而有所限制；(三)學校經費分配未盡理想；(四)學習資源配置不均。學校輔導機制的問題包括：(一)常態編班配套措施未落實，難以兼顧學生程度與特殊需求；(二)教師差異化學習扶助之迷思與學生動機影響施行成效；(三)年級內分組學習存在標籤化的隱憂；(四)年級內分組學習實施時間過晚；(五)學校氛圍與教師專業不足，影響適性輔導成效；(六)課程諮詢教師與專任輔導教師的分工不明確；(七)、國高中部分輔導專業流於形式化；(八)城鄉資源差距與社會觀念偏頗束縛學制轉銜及人才培育理念。

四、對策建議

學校制度與運作的對策建議：(一)將學習扶助納入經費統籌之制度系統，列為學校日常必要執行的政策；(二)考量提早實施年級內分組學習，並擴大學科領域；(三)減輕中小學實施過多、彼此範圍重疊之政策的行政壓力，以專注心力實施因材施教各項政策；(四)再概念化常態編班與年級內分組學習，二者須同時實施；(五)健全實驗教育支持配套措施；(六)禁止私立學校透過類似篩選測驗進行招生、分班的作法；(七)強化高級中等學校多元入學與不同類型間的轉銜；(八)明列學校教師必修因材施教之課程。

學校資源配置的對策建議：(一)引入多元背景之師資，穩定師資人力；(二)提供教育政策實施彈性，提高行政支援量能；

（三）分配經費於因材施教的理念宣導與政策實施；（四）提升教師專業，豐富學習資源。

學校輔導機制的對策建議：（一）實踐多元平等的常態編班，落實學習輔導；（二）落實學習扶助與差異化教學；（三）善用數位科技於差異化教學，翻轉學習弱勢；（四）促進學校處室合作，設計三級輔導工作活動化；（五）規劃合理制度，心理師納入學校正式體系，完備三級輔導機制效能；（六）強化教職員工輔導知能以及導師的覺察能力；（七）善用各類教師角色與輔導組織專業，落實學生進路輔導；（八）培育並引進專業人才，協助學生生涯輔導。

伍、因材施教的課程與教學

本計畫聚焦於臺灣近三十年來因材施教的課程與教學相關政策發展，分析目前面臨的問題，提出符合世代脈絡的相關政策推動策略，以促進臺灣教育的永續發展。本研究目的有四：

- 一、統整近三十年臺灣因材施教課程與教學之政策演進。
- 二、描述臺灣因材施教課程與教學政策的現況與特質。
- 三、分析臺灣因材施教課程與教學政策的問題與挑戰。
- 四、提供因材施教課程與教學相關政策與實務上的建議。

其次，深度訪談曾參與相關政策的教育專家學者與學校實務工作者，以理解政策本研究從概念範疇、政策推動到教學實踐三

層次探討，在教學實踐部分著重三個範疇，分別為：計畫與課程、教學與評量，以及環境與資源。

本研究採用的方法包括文件分析法、訪談法與問卷調查法。首先，以國內官方重要的相關文件進行分析，包含政策白皮書、重要法規、課程綱要、教育方案等。演變、面臨的問題與挑戰及對政策的建議。最後，問卷調查以辦理相關課程政策之 80 所學校為對象，包括一般課程類別如：學習扶助、適性教學、多元選修（高中），以及原住民族教育、新住民教育，分析目前面臨的問題，以提出符合世代脈絡的相關政策推動策略，促進臺灣教育的永續發展。

研究發現臺灣中小學因材施教課程與教學政策面臨的問題如下：

- 一、心理面向因材施教考量與實際挑戰的拉鋸：
 - （一）教師欠缺差異化教學的知能且實施意願不高。
 - （二）學習扶助 / 重修課程考量學習需求，但實際面臨多重挑戰，如開班人數編制過多、無法全數開班、需開設科目過多、師資來源與教師意向低、學生對學扶 / 重修課程缺乏學習動機或教師缺乏時間設計課程等。
 - （三）行政處室間、教師間欠缺整合溝通及政策法規規定彈性不足，不利學習扶助推展。
 - （四）高中多元選修課程受限於教師專長常變成「師本」課程、有些課程名稱與實質內容有落差或開課考量仍與大學升學考科相關、學校間落差加大等多重困境，反而加重教育機會不均等問題。

二、社會面向課程與教學的夾縫處境與長期受忽視：（一）原住民重點學校領域課程受主流社會價值制約和教科書內容影響，甚至有「文化盲」氛圍，少有文化回應教學實踐。（二）開發族語或原住民族知識與文化課程既缺乏願意投入的老師，也缺乏能將原住民族知識與文化體系轉化為適切教材的專業教師。（三）原住民和新住民學生適性教育措施，常在輔導業務受關注，而非於課程與教學受重視。（四）原住民和新住民課程皆面臨學生異質性、學習興趣、教師專業、教學與評量資源的挑戰。

本研究針對研究結果的提出建議：

一、在因材施教整體面向：（一）在概念範疇上重新認知學生差異的交織性與整全性：學生差異是複雜且多重面向交織，針對學生的差異進行更精準明確的評估，以確實理解心理與社會面向形塑的個別差異情形，才能因應差異進行適性教學。（二）採取多重管道協作並進的推動方式：宜採學校場域和民間參與的多重管道，積極鼓勵學校、社區和民間團體攜手合作，創造真正能因材施教的全面社會環境，且視學習對象、主題、情境和脈絡，作為課程與教學設計之多重變項的選定，展現跨界、交織、協力、並進等特徵。（三）建構有效的政策制訂和評估機制：教育部應擬定延續性、中長期的執行評估和影響評估策略，建構良性的「制訂—執行—評估—修正

—執行—評估之循環機制，才能提升政策執行的品質，達成政策的預期效果和影響。

- 二、在課程與教學方面：（一）中小學應發展多樣化學習扶助課程，促進學生參與動機：以多元智能的觀點發展更多樣化的課後扶助課程，例如體育、音樂、美術與戲劇等課程，為弱勢的孩子締造多元學習的機會，激發其主動參與的動機，落實適性扶助弱勢學生的教育目的。
- （二）強化家長對於學習扶助課程的理解與支持，提高學生的參與率：運用新生座談會、班親會、親師生溝通等管道，提供學習扶助入班進步率和成效等資訊，以說服提升家長讓學生入班之意願。
- （三）落實高中多元選修課程，實踐因材施教的課程與教學：高中各校應落實課綱規定，設計以學生為中心的選修課程。若師資不足，可採用兼任教師、跨校聯盟、或和大學端合作開設課程等方式，或者學校與企業、社區組織合作，邀請專家來校講課或參與課程設計。
- （四）族群文化融入正式課程，培養學生群體身份認同：文化貴在實踐，貴在近用，沒有搭配實踐與近用經驗的文化教育是不完整的，建議採取社會行動模式，培養新世代學生的群體身份認同和文化實踐力，讓多元文化得以保存與發揚。
- （五）建構學習扶助教師培訓機制，加強專業教學知能：透過提供包含扶助、課輔的課程與教材設計、多元文化教育觀、親師生和諧關係營造等專業課程與訓練，提升教師學習

扶助能力，並鼓勵教師從事行動研究，解決補救教學現場的問題。（六）推展電腦支持協作學習模式，解決偏遠弱勢小校學習扶助之需求：為解決僧多粥少及小校學習扶助之需求，建議善加運用臺灣普及的網路資源以及班班有平版的設備，打破教室邊界，運用社群教師及資源共享方式，解決偏遠地區學校實施扶助教學的困境。

（七）善用數位工具翻轉課堂，協助弱勢學生更有效學習：教學應跳脫傳統上課模式，確實針對學生的學習問題，選擇多樣性的教材與媒材支援，擬定不同的教學策略，靈活運用多層次補救教學法，透過密集互動與適切的學習策略，協助學生跨越學習斷層。

陸、因材施教的數位學習

本子題之研究，旨在探討臺灣科技輔助因材施教的現況、成效和需求。首先，利用文獻和文件分析，探究世界組織和亞洲各國利用數位科技推動因材施教的趨勢，以及描繪臺灣政策發展脈絡。其次，以高級中等以下學校作為研究對象，瞭解學校科技輔助因材施教在基礎設施、學校行政、教材教法等現況、成效和需求。最後，借鏡國際趨勢，分析臺灣科技輔助因材施教的問題，並提出對策建議，以供各界參用。唯以本研究方法以量化為主，缺少質性資料，且無法確保填答問卷者對於研究議題的全面理解，則為本研究的限制。以下分從政策演進、現況概述、問題分

析、對策建議四方面說明研究結果。

一、政策演進

就國際發展趨勢而言，日本在 2020 年啟動為期四年的 GIGA 計畫 (Global and Innovation Gateway for All)，目前為亞洲地區唯一由政府免費提供學生載具，高級中等以下學校載具學生比為 1：1 的國家（文部科學省，2023）。

韓國為實現全民適性教育，利用人工智慧等先進技術，根據學生的能力和學習速度，提供「為個人量身打造的教育」，在數學、英語和資訊等科目導入 AI 教科書（AI 助教）。

新加坡教育部在官方學生學習平臺 (Student Learning Space, SLS)，增強每位學生個人化學習，如追蹤學生學習過程、利用可視化學習分析功能、支持自主學習的數位資源（包括教科書）等 (Ministry of Education Singapore, 2022a)。

如以我國相關政策的演進來看，自 2012 年起推動「中小學行動學習推動計畫」，鼓勵學校發展資訊科技在教學應用的特色，發展「學習者為中心」之多元創新教學模式。

2016 年委託國立臺中教育大學開發因材網數位適性學習平台（簡稱教育部因材網）(Taiwan Adaptive Learning Platform, TALP)，以開發滿足每位學生的個別需求，提供適性學習資源。目前已經有 4,376 所學校，共 246 萬餘人註冊因材網帳號，是目前國內公部門中最大的數位學習平台。

復於 2019 年推動「科技輔助自主學習計畫」，推廣四學概

念及將數位學習平臺融入日常教學。

2021 年因應行政院前瞻基礎建設計畫，推動縣市「數位學習推動計畫」，採競爭型補助各縣市學校實施科技輔助自主學習、5G 智慧學習與 5G 新科技學習等示範。

進而，教育部自 2022 年起連續 4 年，共投入 200 億元「推動中小學數位學習精進方案」，用於「充實數位學習內容」、「行動載具與網路提升」及「教育大數據分析」。

二、現況概述

依調查結果顯示，我國推動數位學習的現況如下：（一）政府縮短數位城鄉落差的政策及數位學習競爭型計畫成效顯著，偏鄉個人化學習設備相較於一般地區充足。（二）學校無線網路和載具配置顯示出政策成效顯著，但需加強載具管理和維修支援人力，另外，大型互動螢幕的普及率有明顯不足。（三）成立教師社群、使用教育部數位教學指引以及舉辦公開觀議課等措施對科技輔助因材施教較有幫助，而校長領導被認為是最有幫助的行政措施。「利用科技診斷學生能力相關知能」最能幫助教師。（四）學校主要以「教育部因材網」進行因材施教，但未能頻繁使用數位科技來診斷學習弱點，並且在診斷後未能高效地提供學生個人化學習。（五）教育部補助的數位內容及教學軟體以及參與 BYOD 或 THSD 計畫對科技輔助因材施教均有幫助。學校使用數位平臺或數位內容的主要目的是進行自主學習，但教師對生成式

人工智慧的使用不熟悉。

三、問題分析

分析我國數位學習相關問題如下：

- (一) 載具覆蓋率待提升：日本實現 1：1 載具學生比，學生可隨時使用載具進行學習。載具覆蓋率需提升以支持科技輔助因材施教的普及和促進。
- (二) 教學現場大型互動螢幕配置量不足：調查顯示學校缺乏足夠大型互動螢幕，增加大型互動螢幕可提升教學互動性，滿足現場教學需求。
- (三) AI 教科書開發、推動和實施有待政策規劃和引導：韓國逾 2023 年開始發展 AI 教科書，預計 2025 年開始使用，AI 教科書可支持多樣化學習需求，目前已有技術基礎，但仍待相關政策討論與規劃。
- (四) 教師尚未熟悉生成式人工智慧於教學：生成式 AI 的快速發展，教學現場明顯開始受到影響，善用生成式 AI 能有效幫助因材施教的進行，但本研究調查結果顯示生成式 AI 應用於教學為我國教師最不熟悉的教學模式。

四、對策建議

依據上述問題之分析，本研究建議下列因應對策：

- (一) 由「生生用平板」擴大至「生生有平板」：全面提供學生載具，可提高學生學習使用載具的便利性，並延伸學習至家庭。
- (二) 優先補助中小學購置大型互動螢幕：購置大型互動螢幕，可提升教學互動性，並滿足中小學基本數位教學需求。
- (三) 進行課綱微調，研發 AI 教科書：仿效國際趨勢，推動數位教科書法制化，加速 AI 教科書開發，逐步導入中小學。
- (四) 促進數位學習資源和人工智慧平臺公共化：擴大官方學習平臺數位內容開發內容，提高平臺功能兼容性，並導入人工智慧。
- (五) 強化人工智慧、科技診斷與數據本位的數位教學：辦理生成式 AI、科技診斷及數據運用能力等相關工作坊，提升教師數位教學知能。
- (六) 強化 AI 與數位學習之教師支持系統：成立數位學習或 AI 應用於教育之教師社群，進行公開觀議課與專業對話，提升教師數位教學與 AI 專業知能和實務能力。
- (七) 推動中小學校長 / 主任數位學習領導：規劃相關課程，俾利校長具備數位學習領導素養，提高校長或主任利用數位科技改善學生學習的認同。
- (八) 建立獎勵機制，鼓勵學校參與數位學習計畫：研擬獎

勵辦法（例如建立優秀人員出國研習機制），激勵積極應用科技於因材施教卓有成效之縣市或中小學。

（九）強化學習扶助課程運用學習平臺，以利對學習落後學生因材施教：透過各校課程發展委員會、教師社群及教學研究會等，研討如何強化學習平臺運用於學習扶助課程。

（十）加強擴大推動 THSD 計畫：推動中小學數位學習精進方案結果顯示，良好的 THSD 模式能提升學生學習成效，在載具逐漸普及時，可將優良的數位學習模式由學校延伸至家庭，避免載具帶回家之不當使用。

本研究發現「推動中小學數位學習精進方案」政策成效顯著，基於永續創新，未來需提升載具覆蓋率、大型互動螢幕配置及 AI 教科書開發、協助教師熟悉生成式人工智慧於教學等，提出十項對策促進科技輔助因材施教。

柒、結論與建議

綜整本研究五個子計畫的發現，歸納結論並提出對策建議如下：

一、結論

（一）心理學取向的個別差異理論，可供解析影響學生學習

的認知、情意及環境因素，並據以發展因材施教的藍圖。

1. 從認知特性來看，因材施教的重點在於發掘不同學生之優勢智能，助其厚植成功學習經驗。
2. 從情意面向來看，因材施教的重點在於激發全體學生之心理動能，讓其自信、快樂學習。
3. 從社會環境來看，因材施教的重點在於屏除不利學生發展的條件，致力維護教育公義與卓越。

(二) 國際趨勢顯示，世界各國推動因材施教的策略，主要包括學制分軌、課程分流、進路輔導、差異化教學及數位輔助等方面。

1. 中學學制已由雙軌取代多軌，且多以單軌初中銜接雙軌高中。
2. 不論學制有無分軌，各國中學皆以多元的課程分流，試探學生志趣。
3. 學生的進路輔導，各國特色互見，有重觀察試探程序者，有設微型課程分流者，亦有放寬轉學機制者。
4. 各國中小學近年致力推動個人化學習或差異化教學，並提供數位科技輔助。

(三) 20 世紀末，我國教育機會均等政策，繼普及教育、有教無類後，著手推動順應學生個別差異的因材施教工作，近年更嘗試回應學生的社會文化差異。

1. 1990 年代法規已漸關注學生個別差異事宜，只是實務工作未能即時反映。
2. 21 世紀初，學校課程與教學開始務實回應學生的個別學習需求。

(四) 隨著因材施教政策的與時俱進，中小學之學制已從編班與升學方式、實驗與弱勢教育等方面作出調整，但日常運作尚有可再實事求是、精益求精之處。

1. 中小學因應因材施教所作之學制調整，包括縮減班級人數、設置特殊才能班、提供多元入學管道、推展實驗教育，以及關注弱勢教育。
2. 中小學學制運作的因材施教功能，目前遭遇制度慣性與彈性、資源配置以及實驗教育配套等問題。

(五) 中小學的課程與教學，在因應學生個別差異方面，成效普通，主要原因是細節規範不清，資源分配不均，兼以初學乍練，師生動力尚未充分激發。

1. 中小學的差異化課程與教學，除高中多元選修課程，大都未能全面推動。
2. 學校執行差異化的課程與教學，目前碰到規劃未盡周延、師生意興闌珊、教師欠缺相關知能，以及城鄉資源不均等困難。

(六) 中小學因應學生群體之社會文化差異的課程與教學，正在蹣跚學步，實施對象僅及於原住民族與新住民子女，願景尚不明朗。

1. 因應學生社會文化差異的課程與教學，成效高低不一，差強人意。
2. 因應學生社會文化差異的課程與教學，眼前挑戰嚴峻，非但世人長期冷眼以對，主流社會多所羈絆，基礎研究成果更不足以支撐實務進展。

(七) 有關因材施教之數位科技輔助措施，過去十來年間，已有不錯成績，但在軟硬體資源，教師知能、學校參與等部分，仍有不足。

(八) 因材施教與學生輔導的關係，主要表現在學習輔導及生涯輔導上，目前限於某些運作條件不夠周全，影響實施成效。

二、建議

依據上述研究結論，針對「因材施教」之政策規劃與實務推動，提出建議如下：

- (一) 教育人員應充分理解「個別差異」的性質、類別與內容，據以發展因材施教的方法。
- (二) 因材施教的政策規劃與實施，須掌握國際趨勢，借鑒他國相關經驗。

1. 學生升學或生涯進路輔導，可借鏡法國及美國經驗。
 2. 高中以上學校之跨學制轉銜，德國與英格蘭經驗皆有可取之處。
 3. 技術高中重視實務技術的養成，英國的「新學徒制」具有參考價值。
 4. 學制分軌、課程分流、教學分組等因材施教措施，可能造成社會階級再製，故其實施必須審慎，並有配套措施之設計。
- (三) 教育主管機關應確定因材施教的政策主軸，建立政策發展評估系統，以增進因材施教的政策效能。
- (四) 在學制運作方面，常態編班及高中轉銜應賦予更大彈性。
- (五) 在資源配置方面，必須全面提升師資素質，充實因材施教的知能；且須均衡城鄉的人力及物力差距。
- (六) 在適性教學方面，國中小的學習扶助應予常規化，年級內分組學習也該及早擴大實施，且這兩類教學皆需研訂範例指引，避免標籤作用。
- (七) 在高中階段的多元選修課程方面，學生的選課行為，教師的授課意願，以及學校當地資源的落差，皆須正視並加因應。
- (八) 運用數位科技輔助的因材施教，可從教學互動裝置、數位學習平臺、教師支持系統等三方面切入補強。

1. 教學互動裝置方面，在硬體配置上，不僅班班要有大型教學互動螢幕，更要生生皆有平板可用。
2. 數位學習平臺方面，現階段下，宜在數位內容的建構上積極導入 AI 元素，並考慮「學習扶助課程」的使用需求。
3. 教師支持系統方面，學校可藉工作坊、觀議課、教師社群、校長領導及獎勵機制，支持教師提升數位科技輔助教學之知能及參與力度。

(九) 因材施教之學生輔導工作，須凝聚全校同仁心志，引進必要人力資源，然後聚焦心理、生活及生涯輔導，促進學生適性發展。

(十) 強化個別差異及其適應的本土研究，探討社會文化差異影響學生學習表現的機制。

綜整上述十大項建議，除強化「個別差異及其適應」之本土性基礎研究，以及因材施教之國際趨勢的掌握與學習之外，教育主關機關宜參酌本研究之各項建議，審慎研訂「各級學校因材施教實施計畫」，以「因材施教」作為我國教育永續發展的政策主軸，從教育法制與資源配置、課程與教學，以及數位學習等面向，以系統性的思維、階段性的規劃，以及策略性的行動，在各級學校全面推動因材施教之相關措施，彰顯優質教育的特質與成效，實現「因材施教、成就每個孩子」的教育願景。或許，研訂「適性教育白皮書」，提供學校推動因材施教的政策動能和行動指引，是台灣追求優質教育、成就人才的根本之計。

Professor Huang Kun-huei Education Foundation
2023-24 Integrated Research on Educational Policy

Empowering Every Child, Developing Talent According to Aptitude — Visions and Strategies for Quality Education in Taiwan

Brief

Research Team of the Integrated Research on Educational Policy
Professor Huang Kun-huei Education Foundation

2024.10

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Chapter One: Foreword

Since its establishment in 2016, the Foundation has taken "research", "rewarding the outstanding" and "assisting the disadvantaged" as its main missions. Among them, our funded research projects emphasizes applied research characterized by "professional", "indigenous", "empirical" and "forward-looking". These projects conduct in-depth research related to current important education issues in Taiwan, so as to address existing problems. Based on the findings, they propose specific improvement strategies for government's reference. In 2018, the project "*Towards Equity and Excellence: Crisis and Strategies in Taiwan's Educational Development*" was carried out. After 18 months of research, the report "*Towards Equity and Excellence - A Study on Crisis and Strategies in Taiwan's Educational Development*" was completed (Huang, 2019). After discussions at academic seminars, the "*Taiwan Education Crisis Report*" was compiled, revealing that Taiwan's education is facing three major crises, including social class reorganization, mediocre education quality, and imbalanced talent cultivation, and recommended that the government take measures to achieve educational justice. The report also proposes three major strategies to improve the quality of education and cultivate the talents needed by the country in the future (Professor Huang Kunhui Education Foundation Taiwan Education Crisis Report Research Team, 2019). Based on the above work, in 2021, with the theme of "New

Generation, New Education: Talent Cultivation in Social Changes", we explored the three major competencies that the new generation of talents urgently need, including digital competence, democratic competence and global competence, and the corresponding science and technology education, civic education and international education, and later completed the report of *"New Generation, New Education on Talent Cultivation in a Changing Society"* (Huang, 2022). Based on the findings of the above two studies, the Foundation advocates that sustainable development of education in Taiwan in the future must uphold the core values of "justice" and "excellence." For above concepts to yield substantial results, they need to be implemented on students. This is exactly the ideal that Confucius advocated for more than two thousand years, "teaching without distinction and teaching students in accordance with their aptitude." Accordingly, the Foundation conducted an 18-month integrated study in 2023 with the theme of *"Empowering Every Child, Developing Talent According to Aptitude — Visions and Strategies for Quality Education in Taiwan"*.

1. Research purposes and focuses

The main purposes of this study are:

- (1) to discuss the theoretical basis of differentiated teaching.
- (2) to discuss the implementation of major countries in differentiated teaching.
- (3) to review the current situation and problems of laws, regulations

and resource allocation in promoting differentiated teaching in Taiwan

- (4) to review the current situation and problems of personalized curriculum and differentiated teaching in Taiwan
- (5) to review the current situation and problems of digital technology with differentiated teaching in Taiwan.
- (6) to propose specific strategies and actions for implementing differentiated teaching.

Based on the above research purposes, the focuses of this study are as follows:

- (1) Discussion of theoretical basis: Discuss the various individual differences that exist when students learn, and then explain the necessity and possibility of differentiated teaching, as well as the implications for education.
- (2) Trends of related international experience: Explore the background of the school systems in major countries that promotes differentiated teaching, their phases of tracking and guidance measures, characteristics and problems, as well as trends and lessons learned.
- (3) Review of related laws, regulations and resource allocation in Taiwan: Analyze and problems in the design of laws and regulations, related teaching manpower and resource allocation when implementing differentiated teaching in

Taiwan, and propose strategies for improvement.

- (4) Review of related curriculum and teaching in Taiwan: Analyze the current situation and problems of personalized curriculum development and differentiated teaching in Taiwan, as well as factors affecting its effectiveness in implementation, and propose strategies for improvement.
- (5) Review of digital learning with differentiated teaching in Taiwan: Review the current situation and problems of using digital technology in differentiated teaching in Taiwan, and propose improvement strategies for implementing differentiated teaching.

Among the above research focuses, the theoretical foundation chapter mainly illustrates the individual differences of students and the implications for teaching from three major directions: cognitive aspect, affective aspect, and physiological and environmental influences, which serves as the basis for subsequent analysis. The chapter on international trends mainly discusses how the six OECD countries, namely Japan, Germany, Spain, France, the United States, and England, carry out tracking and related guidance activities, their characteristics, and trends in the school systems when implementing differentiated teaching. The following three chapters, which include laws, regulations and resource allocation, curriculum and teaching, and digital learning, illustrate the policy evolution, current situation overview, problem analysis, and strategies and recommendations

related to differentiated teaching in Taiwan.

2. Research methods and approaches

This empirical study includes research methods, such as theoretical analysis, document analysis, international comparison, questionnaire survey, focus group discussion, expert consultation, interviews, ...etc. Empirical data required for the study include: 1. Related archives, regulatory documents, plans, and reports on official education policies and practices; 2. Data related to development in foreign countries; 3. Relevant domestic and foreign research literature; 4. Collection of viewpoints through questionnaires, interviews, consultations, discussions, etc. For each sub-study, appropriate methods are used for data collection and analysis based on its nature and necessities. The following five chapters summarize the research findings of the five sub-studies respectively.

Chapter Two: Theoretical Basis of Differentiated Teaching

Education needs to take into account individual differences of students and provide appropriate teaching content, strategies, and access. By doing so, it is possible to teach students in accordance with their aptitudes and realize their potentials. The "aptitude" refers to the individual differences between students' internal and external systems. According to the "Universal Learning Design Theory", differences of

students' internal systems include differences in cognitive dimensions (intelligence, cognitive style, aptitude, executive functions) and affective dimensions (personality and beliefs, learning motivation, emotions). According to the "Social System Theory", the external system mainly refers to the differences in the social environment (gender, ethnicities and culture, family and school) in which students live.

In terms of cognition dimensions, teachers should assess individual differences of students', meaning "whether they can learn and whether they are suitable for learning" based on the learners' intelligence, cognitive style, aptitude, executive function and other factors. In terms of intelligence, both the triarchy theory of intelligence and the theory of multiple intelligences emphasize that intelligences are rich and diverse, and they emphasize that every student has a variety of different intelligences, which are only different in degree. Educators should design diverse ways of teaching and assessments and strive to be aware of students' intelligence. dominant intelligence, and by encouraging learners to use dominant intelligence and strengthen non-dominant intelligence to achieve balanced development of intelligences. In addition, the teaching methods and teaching progress can also be fine-tuned according to the differences in multiple intelligences of every student to achieve the goal of teaching students in accordance with their aptitude. Cognitive style refers to the way students prefer and habitually organize and represent information.

The teaching method preferred by teachers may not necessarily lead to effective learning of all learners. If a teacher can carry out instructional design with the understanding that each student has a unique starting point and adapt their teaching according to the learner's cognitive style or learning style, there may be better learning results. Aptitude means that before an individual learns a specific thing, he already has the potential ability to learn that thing. The assessment of this potential ability can help teachers guide learners in career exploration, educational placement or as reference for tracking, such as identifying talented students, providing them guidance for further studies (academic senior high schools, comprehensive high schools, vocational high schools), etc. Teachers can also provide differentiated teaching intervention according to learners' aptitudes, which will help students achieve better learning results. Executive function refers to the high-level cognitive abilities (including working memory, inhibitory control, cognitive flexibility, planning, etc.) required by individuals to seek and achieve goals. If certain types of executive functions are impaired, it could lead to specific learning disabilities. Therefore, teachers should plan appropriate executive function training for those with special needs to improve their cognition and learning performance. Differentiated teaching from cognition dimensions means teachers focusing on the areas in which students are good at and in need, so as to achieve the goal of developing students' strengths based on their talents.

In terms of affective dimensions, teachers should assess students' individual differences in terms of "whether they are willing to learn and whether they are willing to learn" based on factors such as students' character beliefs, learning motivation and emotions. Personality refers to an individual's stable patterns of thoughts, feelings, social adaptation, and behavior. Teachers should pay attention to the personality differences of students, apply the principle of adaptability to people and situations, use appropriate learning strategies for learners with low motivation, and provide more effective guidance and support to promote their all-round development. Beliefs refer to the values, attitudes and expectations held by individuals towards learning, including self-efficacy, self-concept and implicit beliefs about intelligence. These beliefs have a critical impact on both academic adjustment and academic performance of students. Therefore, teaching should be targeting learners with low self-efficacy, low self-concept, and different intellectual beliefs. Teachers should guide learners to better understand and affirm themselves, build successful experiences, provide learners with positive feedback and support, effectively manage their emotions, and pay attention to multiple benchmarking, adopt individual differentiated teaching strategies and provide counseling to encourage students to participate more actively in learning. Learning motivation refers to the extent to which students pay attention to and work hard on learning goals. Teachers should understand learners' motivations and adjust teaching strategies for

learners with low motivations or non-adaptive motivations. Strengthen the cultivation of adaptive motivation, encourage positive and positive academic emotions, provide a supportive learning environment, and emphasize intrinsic value to stimulate students' intrinsic motivation and promote their holistic development. Academic emotions refer to various emotions related to academic activities or results generated by learners due to cognitive evaluation when learning. Educators should be aware of states of students' emotion and their performance in time, provide differentiated support for students with emotional distress, and effectively regulate their emotions through positive emotions to help them better cope with academic pressure and realize their potential. Through in-depth understanding of individual emotional factors, developing more appropriate and individualized teaching strategies, and creating a supportive and motivating learning environment, teachers help students to establish a positive attitude and achieve the core goal of happiness and wellbeing.

In terms of social environment, teachers should be mindful whether factors such as students' gender, ethnicities and culture, family and school are "conducive to learning and conducive to learning." In terms of gender, in addition to using gender-sensitive teaching methods to guide students to think about the meaning of gender and the impact of their genders on different aspects of learning, teachers should also provide equitable learning opportunities and conditions for both genders by developing systematic gender equality education programs.

Gender stereotypes that impede the academic performance of students of any gender should be avoided. In terms of ethnicity and culture, our society is composed of diverse ethnic groups. Teachers should enhance cultural sensitivity to increase learning engagement and reduce cultural bias. It is also necessary to pay attention to the learning and adaptation of students from different cultures, use differentiated teaching that is culturally responsive, and create an inclusive and equal learning environment. In terms of family and school, family conditions and school organizational structure and teaching atmosphere have a direct impact on students' learning. Therefore, teachers need to use differentiated teaching methods so that students of different abilities can make progress. In particular, it can improve self-confidence and learning performance of low-ability students. In addition, teachers can also promote the learning effectiveness of students from different backgrounds through collaborative learning and making good use of community resources. Differentiated teaching which takes social environment into account helps Taiwan to achieve inclusive and equitable high-quality education for all. When everyone can enjoy equal learning opportunities in Taiwan, it is possible to achieve the goals of fairness and justice.

To sum up, this section provides a comprehensive review on the theoretical basis of differentiated teaching, so as to better understand and respond to students' individual differences in cognitive aspects, affective aspects, and social environmental factors. Through adaptive

teaching methods, teachers can guide students more effectively to realize their potential and strengths, cultivate students' interests and motivations, and then develop students' strengths based on their talents, achieve happiness and wellbeing, and realise fairness and justice.

Chapter Three: The International Trends of Differentiated Teaching

This section provides a comparative analysis of six countries, including Japan, Germany, Spain, France, the United States and England. The themes include: 1. the concept of differentiated teaching; 2. phase of tracking; 3. the guidance and counselling measures related to tracking; 4. the characteristics of tracking; and 5. the problems of tracking. It is hoped to provide explanations of differentiated teaching in Taiwan through description, interpretation, juxtaposition and comparison of relevant education systems with other countries. In so doing, it provides a comparative perspective for understanding the concept of differentiated teaching, and provides references for related implementation in future reform.

1. The concept of differentiated teaching

- (1) In Japan, there is a great emphasis on equal educational opportunities. There is no consensus on "differentiated teaching" (talent education), and there is no official definition.

From the perspective of curriculum and teaching, the term is similar to the concepts of "personalized education" or "individualized education."

- (2) Traditionally, German believes that education should "teaching students in accordance with their different talents and aptitudes", and tracking begins at the primary school level.
- (3) Due to the socialist tradition, the Spanish government attaches great importance to equal educational opportunities, but it does not have a formal tracking system in schools. It mainly provides adaptive education through differentiated courses.
- (4) There is also great emphasis on the concept of teaching students in accordance with their aptitudes in France. It is carried out via three dimensions: "adaptation", "tracking" and "differentiated teaching".
- (5) In the United States, it also emphasizes that all students have the right to receive high-quality public school education, and it is hoped that through primary and secondary education, all students can fully develop their potential according to their talents.
- (6) Traditionally, there has been serious class problems in English society. The tradition of elite education has led to tracking starting as early as primary school.

2. Phase of tracking

- (1) In Japan, it adopts a 6-3-3-4 school system, and tracking starts when junior high school graduates enter senior high schools. Junior high school graduates can enter academic high schools, vocational high schools or comprehensive high schools, as well as colleges of technology (five years) and professional training colleges (three years).
- (2) In most states in Germany, primary school lasts four years, and students choose either academic or vocational track as they entering different types of lower secondary schools. Since the 21st century, the track system has changed from the traditional three-track system (Gymnasium, Hauptschule and Realschule) to a two-track system (neue zweite Schulform, die Hauptschule/Realschule ersetzt or neue zweite Schulform, Hauptschule/Realschule-Kombination).
- (3) The Spanish school system is a 6-4-2 system. Tracking is implemented via career counseling courses conducted in the fourth year of lower secondary education (3+1) and the tracking formally take place at the upper secondary education, which means students enter either academic high schools then universities, or training-based intermediate professional education.
- (4) The French school system is a 5-4-3 system, and tracking begins at the secondary education stage. In the third year of junior high school, students must choose either entering

general and technical education, or vocational education for further study. When students entering the upper secondary education, they are supported by career counseling, and tracking is carried out based on students' academic performance, aptitude, knowledge and skills.

- (5) In the United States, there is no tracking system in high schools. It is more common in US to group students into ability groups and provide them with different types of curriculum based on different races or students' ability.
- (6) In England, schools are mainly divided into academic and technical tracks. Students pursue further study through the General Certificate of Secondary Education (GCSE) examination at the age of 16 and the General Certificate of Education (GCE, A Level) at the age of 18/19 (academic track). The technical and vocational track develops students' vocational skills through further education or apprenticeship.

3. The guidance and counseling measures related to tracking

- (1) In Japan, it attaches great importance to career guidance for students. After 1999, the "Career Guidance" became a school-wide teaching activity in middle schools and colleges.
- (2) Because tracking started early in German schools, great importance is attached to guidance and counseling in tracking. After graduating from elementary school, teachers

will provide parents with a "Recommendation for Further Study" based on ability and academic performance to provide students with a reference for admission pathways, but parents still have the final say.

- (3) In Spain, a student key competency assessment and counseling mechanism is carried out after the second year of lower secondary education. For students with poor academic performance, it adopts differentiated curriculum plans and basic vocational training to guide students into vocational training.
- (4) In France, the supporting system of tracking for students who plan to enter senior high schools is mainly carried out via long-term continuous observation of students by school teachers and the "Class Representative Consultation Council" which composed of all teachers and parents of the school to make suggestions.
- (5) American students select courses mostly based on personal interests, parents' suggestions, and suggestions from teachers and career counselors based on students' achievements and personal characteristics.
- (6) Schools in England offer different programs based on various considerations, such as student background, government funding and teachers' expertise. The purposes are to meet the needs of students and to pass the courses, diplomas and

certificates required for future studies.

4. Characteristics of tracking

- (1) Adaptive learning in Japan (teaching according to their aptitudes) emphasizes cultivating the qualifications and abilities required by the future society, informatization of school education, individualizing guidance and learning, and enriching the management of schools and courses, but it places more emphasis on career Educational guidance.
- (2) In Germany, although tracking takes place as early as age ten, transitions between different school types have been relatively easy. Moreover, vocational education in Germany has a high return on investment, which also helps to bridge the gap between academic and vocational education.
- (3) There is no tracking in Spain's school system, but in the second year of lower secondary education, subject setting is used to prevent students from dropping out, and further career exploration is provided in the final year of lower secondary education to support tracking.
- (4) In France, the concept of differentiated teaching are included when formulating education policies, and effective, fair and adaptive measures are implemented at the school level. In school, teachers also pay attention to differentiated teaching.
- (5) In the United States, personalized curriculum and differentiated

teaching are carried out mainly through providing students with diverse study plans and elective courses. There are many types of higher education institutions with flexible admissions, allowing students to plan their studies according to personal conditions.

- (6) In England, primary and secondary schools enjoy great flexibility. Each school can develop according to local conditions, diversify and complex secondary school curriculum qualifications, and provide students with multiple school choices.

5. The problem of tracking

- (1) In Japan, the emphasis on equal educational opportunities has limited the development of students with dual special needs.
- (2) Due to early tracking in Germany, different types of schools have become symbols of social class and have led to class reproduction.
- (3) Due to the socialist tradition, Spanish government attaches great importance to equal educational opportunities, and previous educational reforms will be affected by political party policies.
- (4) A likely problem with France's differentiated teaching is that tracking starts early, and different types of schools tend to lead to the reproduction of social classes.
- (5) The problem of differentiated teaching in the United States is

that schools do not provide objective and consistent grading standards to teachers. In addition, ability grouping reinforces racial segregation within schools and has a negative impact on the future academic and career development of economically and culturally disadvantaged students, thereby leading to class reproduction.

- (6) A likely problem with England's differentiated teaching is that early tracking and diverse types of schools tend to lead to reproduction of social classes.

In summary, the findings of this sub-study is summarized as follows:

1. The concepts of differentiated teaching differs due to historic and cultural differences of countries, but the aims of enabling adaptive development of all students is the same for all countries.

These countries have different understandings and practices regarding of differentiated teaching due to historic and cultural differences, but the purpose is to help everyone to have adaptive development.

2. There are different phases of tracking, but they all place great emphasis on providing adequate guidance and counselling for parents' reference.

Due to differences in the concept of differentiated teaching,

these countries have different phases of tracking. However, providing parents with guidance and consultation through diverse ways to help them to choose the most suitable development for their children is valued by all countries.

3. Different tracking systems in these countries show different priorities, but they all adopt the concept of lifelong learning and try to make their transition systems as easy as possible.

Due to the influence of the concept and goals of lifelong learning, six countries all gradually relax their education systems and provide students with more autonomous academic & career choices in more flexible and diverse ways.

Chapter Four: Laws, regulations and resource allocation for differentiated teaching

This sub-study focuses on issues such as school systems and operations (including admission methods), school resource allocation (including teaching manpower), and guidance and counseling mechanisms. The research purposes are:

1. to analyze the policy evolution of Taiwan's laws and regulations on differentiated teaching and the allocation of school resources.
2. to present the current situation of implementation of laws and

regulations, school resource allocation on differentiated teaching in Taiwan.

3. to discuss the implementation issues of laws and regulations on differentiated teaching and allocation of school resources in Taiwan.
4. to analyze the possible strategies that can be adopted in laws and regulations and school resource allocation for differentiated teaching in Taiwan.

For the sub-study, expert consultation, interviews (including physical, online, and telephone interviews), questionnaires, and other methods were used to collect actual data, and used them as references for data analysis. Expert consultation includes 3 scholars and experts; physical and telephone interviews include a total of 18 administrative staff from 11 county and city education bureaus (offices) who were in charge of tasks related to group learning within the same grade; and questionnaire survey include 73 junior high school principals. This study uses both qualitative and quantitative research methods. The study has its limitation due to regional differences, ways of interviews and sampling. Below, research outcomes are shown from four aspects: policy evolution, overview of the current situation, problem analysis, and strategies and recommendations.

1. Policy evolution

In terms of school system and operation in Taiwan, the key points

of the evolution are: 1. the nine-year compulsory education has laid the foundation; 2. The compulsory enrollment regulations and the National Education Law are the cornerstone of compulsory education; 3. The launch of Twelve-Year Basic Education in 2016 is crucial; 4. The high school entrance reform led to the creation of " compulsory junior high school education" and "high school multiple admissions"; 5. Efforts to widening admission access, improved regulations and transition mechanisms for various types of secondary schools; 6. The establishment of public and private schools which address parents' right of choices and students' right to learn; 7. The establishment of laws and regulations related to disadvantaged students, children of indigenous peoples and new residents, and experimental education issues; 8. The support of disadvantaged students and widening admission access for them; 9. The establishment of laws and regulations related to indigenous peoples and indigenous education; 10. Address the issue of education for the children of new residents, and; 11. Vigorous development of experimental education as a new option for differentiated teaching. At present, laws and regulations are still being continuously updated and adjusted to support measures related to the 12-year basic education.

The allocation of school resources is illustrated by teaching staff, administrative capacity, funding allocation, and learning resources. There has been an increase of special needs teachers and an improvement of teacher-student ratio over the years. In terms of

administrative capacity, it places more importance on the allocation of administrative staff and part-time teachers; funds are allocated through the Constitution, the Education Funding Allocation and Management Act, and specific education funding subsidies; and learning resources are based on the National Education Law" and related measures to ensure the quality of teaching and learning.

The development of mechanism for student guidance in learning is divided into: the embryonic stage (before 2000), which focuses on heterogeneous group learning and protection of the educational rights and interests of indigenous students; the development stage (2000 to 2013) emphasizes learning support, disadvantaged groups; and the professionalization stage (2014 to present), deepening adaptive learning support and three levels of guidance and counseling—developmental guidance, intervention counseling, and remedial counseling.

2. Overview of the current situation

The school system and operations can be understood from the school class system, group/class learning, experimental education, and the admission system and channels. School resources are allocated in the directions of teaching staff, administrative capacity, funding allocation, and learning resources. The current implementation status of the student counseling mechanism can be understood from three aspects: study counseling, life counseling, and career counseling.

3. Problem analysis

Problems of the school system and operations related to differentiated teaching include: (1) differentiated learning support has not been fully implemented; (2) policies promoted has not matched the current implementation situation of the school; (3) subject setting within the same grade has not yet been fully implemented; (4) supporting measures for experimentation education have not yet been implemented; (5) the differences between public and private schools are not conducive to the implementation of differentiated teaching; (6) senior high schools have limited flexibility in multiple admissions and transfer; (7) teachers' knowledge of the special need education still needs to be strengthened. Problems with school resource allocation include: (1) The recruitment and retainment teaching staff face challenges, and the proportion of supply teachers is relatively high; (2) The amount of administrative work can be limited due to fixed teaching hours; (3) The allocation of school funds is not ideal; (4) Uneven allocation of learning resources. Problems with the school guidance mechanism include: (1) supporting measures for heterogenous grouping have not been implemented, making it difficult to take into account students' levels and special needs; (2) the myth of differentiated learning support from teachers and student motivation affect effectiveness of the implementation; (3) subject setting within grades: there are concerns about being labelled; (4) subject setting within grades: the time of implemented is too late; (5)

school atmosphere and teachers' expertise affect the effectiveness of guidance for adaptive education; (6) the division of labor between teachers undertake curriculum counselling tasks and full-time school counselors is unclear ; (7) Some guidance and counselling in secondary schools become more form than substance; (8) The gap in urban and rural resources and social stereotypes impedes academic transition and talent cultivation.

4. Strategies and recommendations

Strategies and recommendations for school systems and operations: (1) Incorporate learning support into the funding arrangement and list it as a regular policy that must be implemented by schools; (2) Evaluate the possibility of early implementation of group learning within the same grade and expand subject areas; (3) Reduce the administrative pressure of primary and secondary schools to implement too many policies with overlapping scope must be focused on implementing various policies of differentiated teaching; (4) Reconceptualization of heterogeneous grouping and group learning within the same grade, both of which must be implemented simultaneously; (5) Improve experimental education supporting measures; (6) Prohibit private schools from using similar screening tests to recruit students and classify students into classes; (7) Strengthen the multiple admissions and transfer of different types of senior secondary schools; (8) Make differentiated teaching a

mandatory course for future school teachers.

Strategies and recommendations for school resource allocation:

(1) Bring in teachers with diverse backgrounds to stabilize the teaching staff; (2) Provide flexibility in the implementation of educational policies and increase the capacity of administrative support; (3) Allocate funds to promote the concept of differentiated teaching and implement related policies; (4) Improve teacher professionalism and enrich learning resources.

Strategies and recommendations for school guidance mechanism:

(1) Implement diverse and equal heterogenous grouping and implement learning guidance; (2) Implement learning support and differentiated teaching; (3) Make good use of digital technology in differentiated teaching and flip learning for disadvantaged areas; (4) Promote cooperation between school departments and design activities related to three levels of guidance and counseling; (5) Plan a reasonable system, integrate psychologists into the school's formal system, and improve the effectiveness of the three levels of guidance and counseling; (6) Strengthen the counseling knowledge of faculty and staff and the awareness of tutors ; (7) Make good use of various teacher roles and counseling organization majors to implement student career guidance; (8) Cultivate and introduce professional talents to assist students in career guidance.

Chapter Five: Personalized Curriculum and Differentiated Teaching

This sub-study focuses on the development of personalized curriculum and differentiated teaching policies in Taiwan in the past thirty years, analyzes the current problems, and proposes relevant policy promotion strategies that fit into the context of the generations to promote the sustainable development of Taiwan's education. This research has four purposes:

1. Summarize the policy evolution of personalized curriculum and differentiated teaching in the past thirty years in Taiwan.
2. Describe the current situation and characteristics of personalized curriculum and differentiated teaching policies in Taiwan.
3. Analyze the problems and challenges of personalized curriculum and differentiated teaching policies in Taiwan.
4. Provide policy and practical recommendations related to personalized curriculum and differentiated teaching.

Secondly, in-depth interviews were conducted with education experts, scholars and school practitioners who have participated in relevant policies. This study explored the issue at three levels, from the concepts and categories, policy promotion, to teaching practice. In terms of teaching practice, it focused on three categories: planning and curriculum, instruction and assessment, and environment and resources.

The methods used in this study include document analysis, interviews and questionnaires. First, we analyze important relevant official domestic documents, including white papers, key regulations, curriculum syllabuses, education plans, ...etc. to understand the evolution, problems and challenges faced and recommendations for policy. Finally, the questionnaire survey targeted 80 schools that implement relevant curriculum policies, including general curriculum categories such as: learning support, adaptive teaching, multiple electives (high school), as well as education for indigenous peoples and education for new residents, to analyze the problems currently faced, in order to propose relevant policy promotion strategies that fit into the context so that it is possible to promote sustainable development of education in Taiwan.

The study found that the problems faced by Taiwan's primary and secondary schools in personalized curriculum and differentiated teaching policies are as follows:

1. Psychological dimensions: The tug-of-war between differentiated teaching and practical challenges: (1) teachers lack the knowledge and ability to implement differentiated teaching and have low willingness to implement it; (2) learning support/retake courses consider learning needs, but in reality they face multiple challenges, such as too many classes, inability to open all classes, too many subjects, low teacher resources and

teacher intentions, and students' lack of support for learning support/retake Courses lack learning motivation or teachers lack time to design courses, etc; (3) the lack of integrated communication between administrative offices and teachers and the lack of flexibility in policies and regulations are not conducive to the promotion of learning support; (4) multiple elective courses in high schools are limited by teachers' expertise and often turn into "teacher-based" courses. There is a gap between the names of some courses and their substantive content, or the consideration of starting courses is still related to university entrance exams. The gap between schools is increasing. On the contrary, Exacerbating the problem of unequal educational opportunities.

2. Social dimensions: The marginalized status in curriculum and teaching and its long-term negligence: (1) The curriculum in key aboriginal school areas is restricted by mainstream social values and influenced by the content of textbooks, and even has a "culturally illiterate" atmosphere, with little culturally responsive teaching practice. (2) There is a lack of teachers willing to invest in developing courses on ethnic languages or indigenous knowledge and culture, as well as professional teachers who can transform indigenous knowledge and cultural systems into appropriate teaching materials. (3) Appropriate education measures for aboriginal and new resident students

often receive attention in the tutoring business, rather than in curriculum and teaching. (4) Aboriginal and new resident courses both face challenges from student heterogeneity, learning interests, teacher expertise, teaching and assessment resources.

Based on the research findings, this study makes following recommendations:

1. On the whole: (1) Re-recognize the interweaving and comprehensiveness of student differences in conceptual categories: Student differences are complex and intertwined in multiple aspects. A more precise and clear assessment of student differences is to understand how they are shaped by psychological and social aspects, so that differentiated teaching can be carried out. (2) Adopt a multi-channel collaborative approach to facilitate differentiated teaching: It is advisable to use multiple channels for school and private sectors to work together, It is necessary to actively encourage schools, communities and civil groups to work together to create a comprehensive social environment that can truly teach students in accordance with their aptitude. Differentiated teaching should take learning objects and topics, situation and context into accounts. These are key variables in the design of curriculum and teaching, and they reflect the characteristics of

cross-border, interweaving, synergy, and parallel advancement. (3) Construct an effective policy formulation and evaluation mechanism: The Ministry of Education should formulate continuous, medium- and long-term implementation evaluation and impact evaluation strategies, and construct a benign mechanism of "formulation- execution -evaluation-revision-execution-evaluation" cycle in order to improve the quality of policy implementation to achieve the expected effects and impacts.

2. In terms of curriculum and teaching: (1) Primary and secondary schools should develop diverse learning support courses to boost students' motivation for participation: develop more diverse after-school support courses from the perspective of multiple intelligences, such as sports, music, art and drama and other courses to create diverse learning opportunities for disadvantaged children, stimulate their motivation to actively participate, and implement the educational purpose of appropriately supporting disadvantaged students. (2) Strengthen parents' understanding and support for learning support courses and increase students' participation rate: Use occasions such as orientation events, parent-teacher meetings, and parent-teacher-student communication to provide information such as the progress rate and effectiveness of learning support courses to persuade Increase parents'

willingness to enroll students in classes. (3) Implement diverse elective courses in senior high schools and realize personalized curriculum and differentiated teaching: Each senior high school should implement the syllabus and design student-centered elective courses. If there are insufficient number of teachers, part-time teachers, cross-school alliances, or cooperation with universities to offer courses can be used, or the school can cooperate with enterprises and community organizations to invite experts to the school to give lectures or participate in course design. (4) Integrate ethnic culture into formal courses and cultivate students' collective identity: Culture is valuable in practice and application. Cultural education without matching practice and application experience is incomplete. It is recommended to adopt a social action model to cultivate a new generation of students. Collective identity and cultural practice enable multiculturalism to be preserved and promoted. (5) The establishment of a teacher training mechanism related to learning support to enhance teachers' professional expertise: enhance teacher learning support by providing professional courses and training including support, curriculum and teaching material design, concepts of multicultural education, and creation of harmonious teacher-student relationships. abilities, and encourage teachers to engage in action research to solve problems in the remedial teaching field. (6) Promote

the computer-supported collaborative learning model to assist learning support development in remote and disadvantaged primary schools: In order to meet the needs of above schools, it is recommended to make full use of Taiwan's widespread internet resources and tablet devices in every class to break through the classroom boundaries use teacher communities and resource sharing to solve the dilemma of schools in remote areas implementing learning support measures. (7) Make good use of digital tools to flip the classroom to help disadvantaged students to learn more effectively: Teaching should break away from the traditional model, target students' actual learning problems, select a variety of teaching materials and media support, formulate different teaching strategies, and use them flexibly The multi-level remedial teaching method helps students overcome learning gaps through intensive interaction and appropriate learning strategies.

Chapter Six: Digital Learning with Differentiated Teaching

This sub-study aims to explore the current situation, effectiveness and needs of technology-assisted individualized teaching in Taiwan. First, we use literature and document analysis to explore the trend of world organizations and Asian countries using digital technology to

promote differentiated teaching, and to describe the context of Taiwan's policies. Secondly, take schools as the research object to understand the current situation, effectiveness and needs of school technology-assisted differentiated teaching in terms of infrastructure, school administration, teaching materials and methods. Finally, by drawing on international trends, we analyze the problems of technology-assisted differentiated teaching in Taiwan, and put forward strategies and recommendations for reference by all. The limitations of this study are that the research methods applied are mainly quantitative. There is a lack of qualitative data, and the researchers cannot ensure those who filled out the questionnaire have a comprehensive understanding of the issue. Below, the research findings are presented from four aspects: policy evolution, current situation overview, problem analysis, and strategies and recommendations.

1. Policy evolution

In terms of international trends, Japan launched the four-year GIGA project (Global and Innovation Gateway for All) in 2020. It is currently the only country in Asia to provide free student devices. The ratio of students in schools below senior high schools is 1:1 country (Ministry of Education, Culture, Sports, Science and Technology, 2023).

In order to achieve universal education, South Korea uses advanced technologies such as artificial intelligence to provide

"education tailored to the individual" according to students' abilities and learning speed, and introduces AI textbooks (AI teaching assistants) in subjects such as mathematics, English and information.

The Ministry of Education of Singapore enhances each student's personalized learning on the official Student Learning Space (SLS), such as tracking student learning processes, using visual learning analysis functions, and supporting digital resources (including textbooks) for independent learning (Ministry of Education Singapore, 2022a).

In terms of the evolution of relevant policies in Taiwan, the "Mobile Learning Promotion Plan for Primary and Secondary Schools" has been promoted since 2012 to encourage schools to develop the characteristics of information technology in teaching applications and develop "learner-centered" diverse and innovative teaching models.

In 2016, National Taichung University of Education was commissioned to develop the Taiwan Adaptive Learning Platform (TALP) to meet the individual needs of each student and provide adaptive learning resources. Currently, 4,376 schools and more than 2.46 million people have signed up, making it the largest digital learning platform in the public sector in Taiwan.

In 2019, the Ministry of Education launched the "Technology-Assisted Autonomous Learning Project" to promote the concepts of the four types of self-regulated learnings and integrate digital learning platforms into daily teaching.

In 2021, in response to the Executive Yuan's Forward-looking Infrastructure Plan, the county and city "Digital Learning Promotion Plan" will be promoted, and competitive subsidies will be used to subsidize schools in counties and cities to implement demonstrations such as technology-assisted independent learning, 5G smart learning, and 5G new technology learning.

Furthermore, starting from 2022, the Ministry of Education has invested a total of NT\$ 20 billions for four consecutive years on the "Project to Improve Digital Learning in Primary and Secondary Schools" to "enrich digital learning content", " Electronic learning device and network improvements" and "big data analysis in educational".

2. Overview of the current situation

According to the survey results, the current situation of promoting digital learning in Taiwan is as follows: (1) The government's policy of shortening the urban-rural digital gap and the competitive digital learning plan have achieved remarkable results. Personalized learning equipment is more abundant in rural areas than in general areas. (2) The schools' wireless network and device configuration shows there are great success in related policies, but device management and maintenance manpower need to be strengthened. In addition, the penetration rate of large interactive screens is quite insufficient. (3) Measures such as establishing teacher communities, applying the

Ministry of Education's digital teaching guidelines, and holding public observation classes are considered helpful for technology-assisted differentiated teaching, and principal leadership is considered the most helpful administrative measure. Measures such as "using technology to diagnose students' competences" can best help teachers. (4) Schools mainly carry out differentiated teaching via the assistance of " Taiwan Adaptive Learning Platform", but they rarely use digital technology to diagnose students' learning weaknesses, and fails to provide students sufficient personalized learning support after diagnosis. (5) Digital content and teaching software subsidized by the Ministry of Education and participation in BYOD or THSD programs are helpful for technology-assisted differentiated teaching. The main purpose of using digital platforms or digital content in schools is for autonomous learning, but teachers are not familiar with the use of generative artificial intelligence.

3. Problem analysis

An analysis of issues related to digital learning in Taiwan is as follows:

- (1) Device coverage needs to be improved: Japan has achieved a 1:1 device-to-student ratio, and students can use vehicles to study at any time. Vehicle coverage needs to be improved to support the popularization and promotion of technology-assisted differentiated teaching.

- (2) Insufficient large-scale interactive screens in the classroom: Surveys show that schools lack enough large-scale interactive screens. Increasing large-scale interactive screens can improve teaching interactivity and meet the needs of on-site teaching.
- (3) The development, promotion and implementation of AI textbooks require policy planning and guidance: South Korea began to develop AI textbooks in 2023 and is expected to start using them in 2025. AI textbooks can support diverse learning needs. There is currently a technical infrastructure, but it still needs to be related Policy discussion and planning.
- (4) Teachers are not yet familiar with generative AI in teaching: The rapid development of generative AI has obviously begun to affect the teaching scene. Making good use of generative AI can effectively support differentiated teaching. However, the results of this study show that teachers are least familiar with the application of generative AI in teaching among all teaching modes.

4. Strategies and recommendations

Based on the analysis of the above problems, this study recommends the following strategies:

- (1) Expanding the operation from " Every student uses tablets" to " Every student owns tablets ": Comprehensive provision

of student devices can improve the convenience of students' learning and using the devices, and extend learning to families.

- (2) Prioritize subsidies for primary and secondary schools to purchase large-scale interactive screens: Purchasing large-scale interactive screens can improve teaching interactivity and meet the basic digital teaching needs of primary and secondary schools.
- (3) Fine-tune the curriculum and develop AI textbooks: Taiwan should follow international trends, promote the legalization of digital textbooks, accelerate the development of AI textbooks, and gradually introduce them into primary and secondary schools.
- (4) Promote the publicization of digital learning resources and artificial intelligence platforms: expand the digital content development content of the official learning platform, improve the compatibility of platform functions, and introduce artificial intelligence.
- (5) Strengthen artificial intelligence, technological diagnosis and data-based digital teaching: organize workshops related to generative AI, technological diagnosis and data application capabilities to improve teachers' digital teaching knowledge.
- (6) Strengthen the teacher support system for AI and digital learning: Establish a teacher community for digital learning

or AI applied in education, conduct public observation classes and professional dialogues, and enhance teachers' digital teaching and AI professional knowledge and practical capabilities.

- (7) Promote digital learning leadership by principals/managers of primary and secondary schools: Plan relevant courses to equip principals with digital learning leadership qualities and increase principals' or managers' recognition of using digital technology to improve student learning.
- (8) Establish a reward mechanism to encourage schools to participate in digital learning programs: Develop reward methods (such as establishing a mechanism for outstanding personnel to study abroad) to encourage the active application of technology in counties, cities or primary and secondary schools that excel in differentiated teaching.
- (9) Strengthen the use of learning platforms in learning support courses to facilitate differentiated regarding students who are lagging behind: Through the curriculum development committees, teacher communities and teaching research associations of each school, schools can explore how to strengthen the application of learning platforms in learning support courses.
- (10) Strengthen and expand the promotion of the THSD plan:
The results of the plan to promote digital learning in primary

and secondary schools show that a good THSD model can improve students' learning effectiveness. When the devices gradually become more popular, excellent digital learning models can be extended from schools to families. Avoid improper use of the device when taking it home.

This study found that the policy of "promoting the improvement of digital learning in primary and secondary schools" has achieved significant results. Based on sustainable innovation, in the future, it is necessary to increase device coverage, configure large-scale interactive screens and develop AI textbooks, and help teachers become familiar with generative AI in teaching. It is proposed ten strategies promote technology-assisted differentiated teaching.

Chapter Seven: Conclusions and Recommendations

Based on the findings above, we summarize the conclusions and put forward strategies and recommendations as follows:

1. Conclusions

- (1) The theories of individual differences from a psychological perspective can be used to analyze the cognitive, affective and environmental factors that affect students' learning, and to develop a blueprint of differentiated teaching.
 - a. In terms of cognitive features, the focus of differentiated teaching is to explore the dominant intelligence of different students

- and help them develop successful learning experiences.
- b. In terms of the affective dimensions, the focus of differentiated teaching is to stimulate the psychological motivation of all students so that they can learn confidently and happily.
 - c. In terms of social environment, the focus of differentiated teaching is to eliminate conditions that are unfavorable to students' development and strive to maintain educational justice and excellence.
- (2) International trends show that the strategies used by major countries around the world to promote differentiated teaching mainly include tracking, curriculum setting, path guidance, differentiated teaching and digital assistance, etc.
- a. Multi-track school systems found in most countries have been replaced by dual tracks, while single-track junior high schools connecting to dual-track high schools is found in most countries
 - b. Regardless of whether school systems of these countries have tracking systems or not, secondary schools in various countries use diverse curriculum to support educational setting to explore students' interests.
 - c. Students' career guidance in these countries have their own unique characteristics. Some emphasize procedures related to teachers' observation and students' exploration, some set up micro-courses to support tracking, and some have more

relaxed measures for transition.

- d. In recent years, primary and secondary schools in various countries have been committed to promote personalized learning and differentiated teaching, and provide digital technology assistance.
- (3) In terms of equal educational opportunities policy in Taiwan, the government began to promote teaching in accordance with students' individual differences at the end of the 20th century following the policies of universal education and education for all without discrimination. In recent years, it also tried to respond to individual students' social and cultural differences.
 - a. In the 1990s, educational regulations in Taiwan began to address individual differences among students, but not much work had been implemented.
 - b. At the beginning of the 21st century, school curriculum and teaching began to respond to the individual learning needs of students.
 - (4) As the policy of differentiated teaching keeps pace with the times, the school system has been adjusted, such as approaches of student grouping and admission for further study, experimental education, and education for disadvantaged groups, but there is still room for dealing with the matter more realistically and striving for excellence in

- daily operations.
- a. Adjustments of the school system in response to differentiated teaching, including reducing class sizes, setting up special talent classes, providing multiple admission access, promoting experimental education, and paying attention to education for the disadvantaged.
 - b. The operation of differentiated teaching in primary and secondary schools currently encounters problems related to institutional inertia and flexibility, resource allocation, and supporting mechanism for experimental education.
- (5) Curriculum and teaching in primary and secondary schools have mediocre results in responding to individual differences among students. The main reasons are unclear specification of details, uneven distribution of resources, and the lack of full motivation among teachers and students due to the lack of motivation for beginners.
- a. Except for the multiple elective courses in senior high schools, personalized curriculum and differentiated teaching in primary and secondary schools have mostly failed to be fully promoted.
 - b. Schools which implement personalized curriculum and differentiated teaching currently encounters difficulties such as incomplete planning, lackluster teachers' business, teachers' lack of relevant knowledge, and uneven urban and rural

resources.

- (6) Curriculum and teaching in schools that respond to the social and cultural differences of different student groups are still in their infancy. The implementation currently only targets children of indigenous peoples and new residents, and the vision is still unclear.
 - a. Curriculum and teaching that respond to students' social and cultural differences have varying degrees of effectiveness and are far from satisfactory.
 - b. Curriculum and teaching that respond to students' social and cultural differences face severe challenges. Not only these issues has been neglected by the society for a long time, they are also impeded by views of mainstream society, and findings of basic research are not sufficient to support the progress of implementation.
- (7) Regarding digital technology-assisted measures for differentiated teaching, good results have been achieved in the past ten years, but there are still deficiencies in software and hardware resources, teacher knowledge, and school participation.
- (8) The relationship between differentiated teaching and student counseling is mainly reflected in academic counseling and career counseling. Currently, due to their limited operation conditions, the effectiveness of their implementation is

affected.

2. Recommendations

Based on the above conclusions, the following recommendations are put forward for the policy planning and implementation of "differentiated teaching":

- (1) Educators should fully understand the nature, classification and content of "individual differences" to develop approaches of differentiated teaching.
- (2) The policy planning and implementation of differentiated teaching in Taiwan must stay on top of international trends and learn from relevant experiences of other countries.
 - a. Regarding counseling for students' further studies or career paths, we can draw on the experience of France and the United States.
 - b. There are things we can learn from the transition practice in upper secondary school system in both Germany and England.
 - c. Technical high schools in most countries attach great importance to the cultivation of practical skills. "New apprenticeship system" in England can be useful reference for Taiwan.
 - d. Measures of differentiated teaching, such as tracking, class streaming, and subject setting, may cause social class reproduction, so their implementation must be prudent and supporting measures must be included.

- (3) The education authorities should determine the main policy axis of differentiated teaching and establish a policy evaluation system to enhance the policy effectiveness of differentiated teaching.
- (4) In terms of the operation of the academic system, there should be greater flexibility in heterogeneous grouping and transition services in high school.
- (5) In terms of resource allocation, it is necessary to improve the overall quality of teachers and enrich their knowledge and ability of differentiated teaching; and there should be equal distribution of personnel and material resources between urban and rural areas.
- (6) In terms of adaptive teaching, learning support in primary and secondary schools should be regularized, and group learning within the same grade should also be expanded as early as possible. Official guidelines for above two types of teaching need to be developed to avoid labeling.
- (7) Regarding the diverse elective courses at the high school level, students' course selection behaviors, teachers' willingness to deliver them, and disparity in local resources among schools in different areas should be taken into account and responded to.
- (8) Digital technology-assisted differentiated teaching can be strengthened from three aspects: interactive teaching devices,

digital learning platforms, and teacher support systems.

- a. In terms of teaching interactive devices, not only every class must have a large interactive teaching screen, but also every student should have a tablet at hand.
 - b. In terms of digital learning platforms, at this moment, it is advisable to actively introduce AI elements into the construction of digital content and consider the needs of those who take "learning support courses".
 - c. In terms of teacher support system, schools can use workshops, observation classes, teacher communities, principal leadership and reward mechanisms to support teachers in improving their knowledge and engaging in digital technology-assisted teaching.
- (9) There should be a shared commitment among all colleagues in school to the work of guidance and counseling related to differentiated teaching. Schools should also bring in necessary human resources, and focus on students' psychological, life and career counseling, to facilitate their adaptive development.
- (10) Strengthen indigenous research on students' individual differences and related adaptation, and explore how social and cultural factors affect students' learning outcomes.

To sum up the above ten recommendations, in addition to strengthening indigenous basic research on "individual differences and

related adaptation" in Taiwan, better understanding of international trends and learn from them, the relevant education authorities should refer to the recommendations of this study and formulate "Development Plan for Differentiated Teaching in Schools at All Levels", takes " differentiated teaching" as the main policy axis of the sustainable development of education in Taiwan, and systematically implements it from the aspects of related laws, regulations and resource allocation, curriculum and teaching, and digital learning. Through comprehensive thinking, phased planning, and strategic actions, we can promote relevant measures for differentiated teaching in schools at all levels, demonstrate the characteristics and effectiveness of high-quality education, and realize the vision of "empowering every child according to one's individuality." Perhaps, a fundamental approach to pursue high-quality education and to develop talents in Taiwan is to formulate a "White Paper on Adaptive Education". This can provide schools policy momentum and action guidance to carry out differentiated teaching.

因材施教，成就每個孩子 — 台灣優質教育的願景與對策 提要

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